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OF THE

PRESBYTERIAN HOSPITAL

IN THE

CITY OF NEW YORK

VOLUME V.
JANUARY, 1902

EDITED BY

ANDREW J. McCOSH, M.D.
W. GILMAN THOMPSON, M.D.

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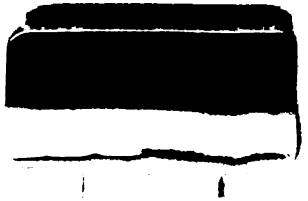

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ANDREW J. McCOSH, M.D.

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I.

TUMOR OF THE BRAIN.

Localization in the Motor Zone—Operation—Successful Removal—Recovery.

By M. Allen Starr, M.D., and A. J. McCosh, M.D.

MEDICAL HISTORY, BY DR. STARR.

Mrs. S. H., aged forty-five, was brought to me on November 1, 1900, by Dr. Bush. She had been fairly healthy all her life, had had a large family and presented no symptoms of syphilis. In July, 1900, she was exposed to intense heat, and in consequence had a general convulsion, after which she was ill for two or three days. The convulsion did not leave any paralysis or ill-effects, but was repeated in two weeks, and recurred at intervals of two or three weeks, until September, at which time she had a miscarriage. She recovered from this miscarriage, but during the month became progressively weaker and thinner, losing about forty pounds in weight before November 1. Her general health has been poor, she has suffered a good deal from headache, from dizziness, and occasionally has thought that her vision was growing dim. She has also suffered from convulsive attacks, which since September have been limited to the left side of the body. The attack begins with a numbness in the fingers and thumb, which extends up to the wrist and then up the arm and to the side of the neck. Soon after the numbness is perceived, clonic spasms begin in the finger and thumb, then in the wrist, the forearm is flexed and rotated, the arm is abducted and shakes violently. As the spasm reaches the shoulder and the numbness reaches the neck, she becomes unconscious and falls. The convulsion then extends to the leg, and occasionally the face also is drawn. The attack lasts from one to three minutes, leaving her much prostrated and weak in the left side.

Examination showed no strabismus, no choked disk, no paralysis of the face or tongue, and no disturbance of speech. Her left

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hand and arm are weaker than the right, pressure on the dynamometer being 40 as contrasted with 65 in the right hand. Wrist and elbow and knee jerks are increased on the left side. There is a slight difference to touch in the left arm and hand, but there is no absolute anæsthesia and no diminution of perception of points. It is a subjective sensation of difference in contact only. There is no hemianopsia. She can perceive objects placed in her hand and name them when blindfolded, and her sense of position of the hand is good. There is no ataxia in the hand.

Diagnosis.—The diagnosis of a tumor in the right posterior central convolution in its middle third was made and an operation was recommended to be done at once, but it was thought best to try the effect of specific treatment before an operation was resorted to; hence she was put upon inunctions and increasing doses of iodide of potash. She had been treated freely by bromides during the summer, but they had had no effect upon the attacks. During the month of November, while under specific treatment, her attacks increased in frequency and severity so that by December 1 she was having as many as eight a day. They then decreased, so that by February 1 she was having but one attack a day, but her general health was worse, and her emaciation had become extreme. Specific treatment, having failed to relieve her, had been stopped in January. On March 19 examination showed an increased weakness of the left hand and a beginning optic neuritis in both eyes without any apparent affection of vision. Her left leg, however, was becoming weak, so that she limped in walking and was quite unsteady upon her feet. Her headaches were not very intense.

She was then induced to enter the Presbyterian Hospital for an operation. She entered the hospital on March 21 and was observed in the surgical ward for five days, during which time her attacks continued. They were uniformly like the ones already described, being distinctly limited to the left side of the body, beginning in the left hand and arm, and involving the left leg, but not the face.

SURGICAL HISTORY, BY DR. McCOSH.

It was decided that the tumor could be best exposed and removed by the elevation of a bone flap corresponding to the motor area, with a hinge at its lower extremity. The instrument selected for this purpose was the Doyen electric saw. On March 26, 1901,

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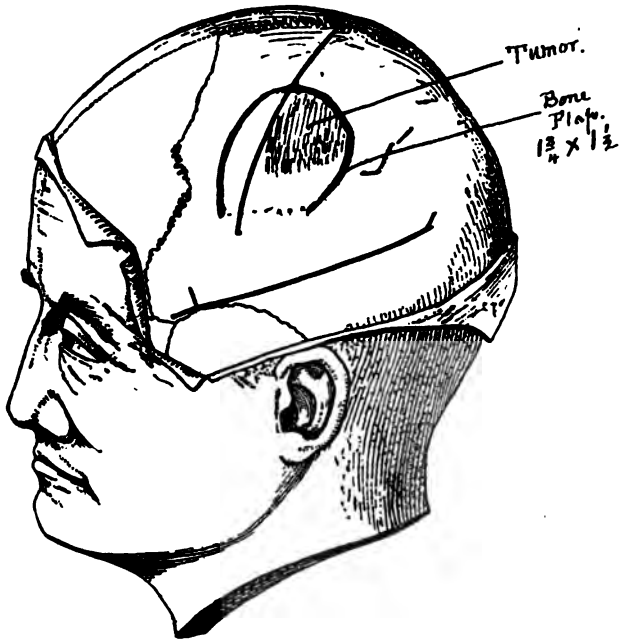
under gas and ether anæsthesia, a scalp incision down to the bone, in the shape of a horseshoe, was made, its posterior limit beginning one inch above the base of the mastoid process, and its anterior limit terminating one inch posterior to the external angular process. Its curved portion extended upward to within one inch of the median line. With the electrical burr of Doyen, five holes were bored at points of equal distance along the line of incision. The skull between these openings was then sawn through with Doyen's elec-



THE INCISION WAS MADE ON THE RIGHT SIDE OF THE SKULL, NOT ON THE LEFT SIDE SHOWN IN THE DIAGRAM.

trical saw. The base of the flap where the skull was not divided was about 1½ inches in width. With a few strokes of the chisel the bone flap was entirely loosened except at its base, and on being gradually elevated at several points, the base was broken and the flap turned downward, being attached only by its hinge of scalp. An area of brain, covered by dura 1¾ × 1½ inches, was thus exposed, its central line in an antero-posterior direction being the fissure of Rolando. Toward the upper part of the area ex-

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posed, the dura was seen to be somewhat thickened, lacking in lustre and slightly bulging outward. It was incised by a + incision, and the four flaps retracted. It was not adherent. The surface of the brain, posterior to the fissure of Rolando and toward the upper part of the area exposed, presented an ivory-like appearance and a freedom from the blood-vessels usually seen on the surface of the cortex. The contrast in color between this well-limited area, which was oval in shape (1½ × 1¼) and slightly bulging outward, was quite noticeable. On palpation a slight increase of resistance was felt.

The sensation imparted to the finger, together with the altered appearance of the cortex, indicated the presence of a tumor immediately beneath. A careful division of the superficial brain tissue, at this point, disclosed a tumor which projected almost to the surface. This tumor, somewhat oval in shape, harder in consistence and more yellowish in color than the surrounding brain tissue, was carefully freed and lifted out of its bed, which was found to extend down into the white matter of the brain. At its deepest part the tumor did not appear to be clearly limited by its capsule, but, extending in a narrower prolongation inward and downward, merged almost imperceptibly into the normal white matter. Blunt dissection, at a point apparently beyond the growth, freed the tumor, which was lifted out of its bed. The tumor measured 1 × 1½ × 1 inch. Externally it was smooth. It was dark gray in color and non-vascular. The pulsation, which had been rather feeble at this point, was resumed almost immediately after the removal of the tumor; the bleeding was but slight. The dura was sutured with fine catgut, the bone flap replaced and held *in situ* by suture of the scalp, a small strip of rubber tissue being introduced at one angle.

Pathological Report, by Dr. Thacher.—Specimen measures 1½ inches in diameter. The uncut surface is smooth, flattened, and covered by pia mater. The cut surfaces are very like cut surfaces of cerebral white matter in color, though of a faint grayish yellow tinge. The consistence is slightly firmer than that of ordinary cerebral tissue, but not uniform, there being two portions on opposite sides of the tumor which are considerably harder than the rest. It is impossible to distinguish normal tissue in the cut surface from tumor tissue. *Microscopical Examination.*—Small round cell sarcoma. Many of the cells are of about the size of lymphocytes,

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many are considerably larger and angular in outline. These are seen, in sections hardened in Zenker's fluid, to have their nuclei frequently at the edges of the cells and some of them seem to have 2 to 5 nuclei.

Medical History.—On the day following the operation the patient was found in a state of complete hemiplegia on the left side with loss of muscular sense, great diminution in the sense of touch, temperature, and pain. This condition of hemiplegia gradually subsided, and by the middle of May she was able to be up and about, could walk fairly well with a slight limp, there being at that time some spastic rigidity of the leg, dragging of the foot, and increased knee-jerk. Her left arm was completely paralyzed, in a state of contracture, fingers and thumb being flexed and wrist flexed and pronated and elbow flexed. She could move all the joints slightly and slowly, and any attempt at motion gave rise to athetoid movements of the fingers. There was still anæsthesia upon that side. February 1, 1902, the hemiplegic condition has almost entirely subsided. She walks well, not dragging the foot, but the knee-jerk is still increased. Her arm is recovering. She can now raise it to her head so that she is able to fix her hair, and she can use the hand in simple motions. On any movement there is a constant athetoid movement set up in the fingers and all fine movements of adjustment are much impaired. Her tactile sense in the hand is still much impaired. She is unable to recognize objects placed in her hand. Sensation of temperature and of pain appears to be acute, but muscular sense is considerably impaired, as she cannot reproduce forced positions given to her hand in the other. Elbow- and wrist-jerks are increased. She has had no attacks since the day of the operation. She has no headaches. The optic disks are normal, all trace of the neuritis having subsided. She has no vertigo. Has gained about twenty pounds in weight, and looks and feels very well.

Comments.—Successful operations upon tumors of the brain are of sufficient rarity to warrant the report of this case. The local indications were so distinct as to leave no doubt in regard to the diagnosis, and it is only to be regretted that the operation could not have been done six months earlier, when the tumor undoubtedly would have been much smaller and the resultant danger from its removal would have been less.

The case is of interest chiefly from the fact that the removal of

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the tumor, which was attended by an inevitable destruction of a small region of the lower portion of the superior parietal lobule, has resulted in a condition of astereognosis in the left hand, with disturbance of tactile and muscular sense. In a case reported by us in the *Psychological Review*, January, 1895, a condition of loss of muscular sense and ataxia in the hand attended the removal of a tumor from the same region, but this was of temporary duration, as the tumor was a very small one. In the case here reported, this condition has remained for nine months and shows no signs of subsiding. The case does not, however, absolutely determine the location of memories of touch in the superior parietal lobule, because of the fact that the fibres within the centrum ovale passing both to this lobule and to the posterior central convolution were damaged during the operation. It only offers an indication, which is quite clear, in favor of the localization of sensations of touch and of the muscular sense in the cortex of the convexity, inasmuch as absolutely no damage was done to the hippocampal gyrus or to the median surface of the brain in the convolutions of which some authorities have located these senses.

Walton, in a recent study of the subject of stereognosis,* has shown that our perception of the nature of an object by touch is the result of a combination of numerous sensations; tactile, temperature, muscular sense, space sense, and pressure sense being all involved. The resulting concept, or memory picture, of an object perceived through these senses has a separate localization in the cortex from the senses themselves, as is proven by the fact that it may be lost independently of those senses, or where they are preserved. Flechsig has recently insisted upon the separate location of the association centres of the cortex from the perceptive centres.† The cases reported by Walton, as well as the one here recorded, seem to support the view of the existence of a set of higher centres superior to those of the senses, in which sensations are combined into concepts. And our case is in accord with the cases of Walton in indicating that the situation of these higher centres is in the cortex adjacent to and posterior to the motor zone.

* Journal of Nervous and Mental Disease, April, 1901; Brain, October, 1901.

† Lancet, October 19, 1901.

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II.

SIMPLE OR ROUND ULCER OF THE DUODENUM.*

By Francis P. Kinnicutt, M.D.

It is intended in the present paper chiefly to record the cases of simple or round ulcer of the duodenum which have come under the observation of my colleagues and myself in the past several years in the wards of the Presbyterian Hospital, and to report two additional cases, one occurring in the wards of St. Luke's Hospital and one in private practice.

Since the beginning of 1893, five cases of duodenal ulcer have been under observation in the Presbyterian Hospital, in four of which autopsies were obtained. In the fifth case the lesion was demonstrated in the attempt to save life by surgical interference. In the remaining two cases reported, autopsies were also obtained.

During the period dating from 1893, a diagnosis of ulcer of the duodenum was made in five other cases under observation in the Presbyterian Hospital, and in one case occurring in private practice. Five of the cases recovered, and in the sixth, terminating fatally by hemorrhage, an autopsy was not permitted. In this case, the clinical history strongly suggested a tuberculous origin of the lesion.

Although the cases in which simple or round ulcer of the duodenum was found to be present at autopsy add little to our knowledge of the etiology, the symptomatology as distinguished from that of peptic ulcer of the stomach, or the pathogenesis of the disease, their histories, nevertheless, contain many points of interest.

The frequency of simple ulcer of the duodenum has been variously estimated by different authors. It is evidently impossible to form an accurate estimate from the number of cases diagnosed as such during life, on account of the great uncertainty of the diagnosis. The largest number of post-mortem records which have been studied

* This article has already appeared in part in the Festschrift, dedicated to Dr. Jacobi.

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for the purpose of eliciting this point are those of Perry and Shaw,[1] published in "Guy's Hospital Reports of 1893." In 17,652 autopsies made at Guy's Hospital from 1826 to 1893, seventy cases of duodenal ulcer, open or healed, were found; that is, in 0.4 per cent. of persons dying from all causes. In 8,192 autopsies made at St. George's Hospital, London, between 1863 and 1893, Latham[2] found twelve cases of perforating ulcer of the duodenum; therefore, in 0.14 per cent. of persons dying from all causes. The number of cases of non-perforating and healed ulcers apparently was not investigated. Turning to Continental statistics, in 5,000 autopsies at the Pathologico-Anatomical Institute of Prague,[3] six cases of duodenal ulcer, 0.1 per cent., are recorded.

Plange,[4] Steiner, and Wollmann[5] collectively report 22 cases in 4,802 autopsies, 0.45 per cent. In 1,150 autopsies made by Grunfeld[6] in Copenhagen, four instances of ulcer of the duodenum, 0.34 per cent., were observed.* In 1,124 autopsies made at the Presbyterian Hospital, New York, from January 1, 1893, to January 1, 1900, perforating and non-perforating ulcers were present in four cases, in 0.35 per cent. of persons dying from all causes. The fatal case in which this lesion was discovered at operation, autopsy not being permitted, would increase the percentage to 0.44. Undoubtedly, cicatrices of healed ulcers in the duodenum are frequently overlooked and in several of the statistical records quoted, it is not especially stated that the number of cases includes cicatrized ulcers. In the large number of post-mortem records studied by Perry and Shaw,[1] the seventy cases include all duodenal ulcers, open or healed. The percentage agrees so closely with those of the Berlin, Copenhagen, and our own records, that it would seem justifiable to conclude that simple ulcer of the duodenum, cicatrized or open, is found in about 0.4 per cent. of persons dying from all causes.

The pathogenesis and pathology of duodenal ulcer correspond in their main features with those of gastric ulcer. The digestive action of the gastric juice is universally accepted at the present time as an essential factor in its pathogenesis. The situation of the duodenal lesion, almost without exception between the pylorus and the biliary papilla, above the point of neutralization of the gastric juice by the pancreatic secretion, hardly permits any other explanation. The frequent coexistence of gastric and duodenal ulcers, presenting simi-

* Since January, 1900, no instance of duodenal ulcer has been found at autopsy.

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lar anatomical characteristics, further corroborates this view. The hypothesis of a localized antecedent impairment of nutrition, variously produced, of the mucous membrane, as a necessary pathogenetic factor, is equally accepted. A hyperacidity of the gastric juice which obtains very generally in gastric ulcer has not been demonstrated in a sufficient number of cases to admit of judgment in regard to its etiological importance. Diminished acidity has been observed in a certain number of cases. The features in which duodenal ulcer especially differs from ulcer of the stomach are of much interest, and their explanation is still largely hypothetical. They are the comparatively frequent occurrence of duodenal ulcer in the new-born; the greater frequency of the lesion in males than in females, the ratio being estimated by Collin[7] as 3.9 to 1, a ratio the reverse of that which obtains in gastric ulcer, which is three females to two males; especial pathological conditions with which duodenal ulcer have been observed to be associated, and which are variously considered as predisposing causes, and, finally, the frequency of certain complications of the gravest character.

The duodenal ulcer of the new-born presents the anatomical characteristics of the lesion in the adult. Severe hemorrhage is a common accompaniment, giving the earlier name, melæna neonatorum, to the disease. From its occurrence in new-born children who have lived only a few hours, an intra-uterine origin has been surmised. Landau's hypothesis,[8] based upon the observation by him of two cases with autopsies, that the lesion is due to thrombosis of the umbilical vein with embolism and consecutive necrosis of a circumscribed portion of the mucous membrane, is probably correct. The greater frequency of ulcer of the duodenum in males leads Boas to suggest an ingenious hypothetical explanation.[9] He ascribes it pre-eminently to the use of alcohol and tobacco, basing his hypothesis upon the well-known experimental investigation of Von Mering and Moritz on dogs. It has been shown by them that the stomach expels water into the intestine with great rapidity; and, further, that alcohol, salines, dextrine, and acids, although absorbed by the stomach, are taken up by it to a very limited extent; that the water first discharged contains these substances in a very concentrated solution; and that the fluid portions of the chyme are first released by the stomach, the solid portions following more slowly. The duodenal membrane is thus much less protected against con-

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centrated solutions than the stomach, whose mucous membrane is relatively protected during the first stage of digestion by the porridge-like or solid chyme.

It is, therefore, through the action of concentrated acid, saline, and alcoholic solutions upon the duodenal membrane already irritated by a presumably hyperacid gastric juice that a necrosis occurs. It is not clear whether Boas believes that the concentrated solutions *per se* are capable of producing that impairment of nutrition which has been accepted as a necessary antecedent to a peptic digestion of the mucous membrane. The views of clinicians vary in regard to the etiological importance of alcohol. My own observations would lead me to regard its excessive use as a distinct predisposing cause of duodenal ulcer. It is quite certain that its abuse may precipitate the gravest symptoms. In two of the cases whose histories are appended, there had been an excessive alcoholic habit for years, and in three of the remaining seven a moderate habit.

In Case II., acute symptoms had several times occurred on especial excess, and in both Case II. and Case V. a sudden development of the complications which resulted fatally occurred during a period of excessive drinking. Among the associated pathological conditions found in duodenal ulcer, burns of the external surface and septicæmia are of especial interest. A causal relation would seem to be borne by them. Especially true is this of burns, and various theories have been advanced in explanation of the relationship.

Circulatory disturbances which are conspicuous at least in the form of congestion and ecchymoses throughout the course of the intestinal tract, in burns of the external surface, in connection with the conditions favorable for autodigestion which exist in the upper portion of the duodenum, form the basis of these hypotheses.

The formation of thrombi and emboli through the liberation of a soluble fibrin ferment, hyperæmia and ecchymoses due to a diminution of vascular tone, a reflex effect of excessive irritation of the nervous system, congestion and ecchymoses due to the excretion through the bile of toxins of an irritating character absorbed from the injured skin (Hunter),[10] are variously believed to represent the nature and the cause of the circulatory disturbance. Billroth [11] believes the lesion to have its origin in a special form of septicæmia, and Perry and Shaw [1] regard a septic condition of the burnt surface as the direct cause of the ulcer. It is interesting to note in this con-

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nection that the Guy's Hospital records indicate that duodenal ulcer is associated with a general septic or pyæmic condition nearly as frequently as with burns. It is also a fact that cases of duodenal ulcer following burns are much rarer in the literature of the past ten years than earlier; that is, with improved methods of treating wounds.

The most reasonable explanation of the relation between the duodenal lesion and septic infection would seem to be in the occurrence of small extravasations of blood in the duodenal mucous membrane such as are commonly observed in the serous and mucous membranes in general sepsis, due as a rule to infective emboli. The subsequent digestive action of the gastric juice would complete the process. The rarity of gastric ulcer both in burns and in general septic or pyæmic conditions remains unexplained. Among other diseases with which duodenal ulcer has been found associated, and variously regarded as predisposing causes, are nephritis, tuberculosis, cardiac disease, erysipelas, trichinosis, pemphigus, and frost-bite. That the association of nephritis may be regarded as more than a coincidence is suggested by the statistics of Perry and Shaw.[1] In the 70 cases of duodenal ulcer occurring in Guy's Hospital, nephritis was present in 12 cases, sixteen per cent., whereas some form of nephritis existed in only seven per cent. of persons dying from all causes in the hospital.

Boas[9] believes that the influence of the renal disease in producing the lesion resides in the necrotizing effect of the urea or its derivative ammonium carbonate retained in the blood-current. A more reasonable explanation in many cases would seem to be in an endarteritis or sclerosis of the duodenal vessels.

In the cases of duodenal ulcer associated with advanced pulmonary tuberculosis which I have been able to collect, the lesion is described in many instances as presenting all the anatomical characteristics of peptic ulcer. In several, perforation occurred. In some cases the ulceration was confined to the duodenum, in others a typical peptic ulcer was present in the duodenum, and multiple ulcer of the ordinary tuberculous type was found in the jejunum and ileum. Although the tuberculous origin of the duodenal ulcer in such instances admits of a legitimate doubt, there are a few observations which indicate that the lesion may originate in a tuberculous cheesy degeneration of a solitary follicle, with softening, and gradually ac-

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quire the characteristics of the simple ulcer through the peptic action of the gastric juice.

Although diseases of the heart, both myocarditis and endocarditis, are found in a considerable number of cases of duodenal as well as gastric ulcer, the association is not as frequent as would be anticipated in view of the theories of the important part which circulatory disturbances play in the pathogenesis of the affection. In 262 cases collected by Collin,[7] the heart was normal in ninety per cent. This is also true of diseases in which the portal circulation is affected primarily or secondarily. In Collin's[7] cases atrophic cirrhosis of the liver was noted only seven times. In our own cases, endocarditis coexisted with the duodenal lesion in three of the six cases in which a full post-mortem examination was made.

Single cases of trichinosis associated with duodenal ulcer have been reported by Ebstein[12] and by Klob.[13] Ebstein regards the relation as a causal one.

Coexistent pemphigus has been reported by Malherbe[14] and Lignerolles[15] in two cases. Two cases[16 & 17] of duodenal ulcer and one[18] of gastric ulcer associated with frost-bite have been published. Billroth believes the relationship to be a causal one and of a septicæmic nature.

The complications peculiar to duodenal ulcer are those due to involvement of the biliary papilla in the cicatricial tissue of healing or healed ulcers. In Collin's[7] 262 observations there were three instances of occlusion of the common bile-duct from this cause. Two cases of general dilatation of the biliary and hepatic ducts almost to the surface of the liver, and two cases of stenosis of both the biliary and pancreatic ducts, were also observed.

Among the serious complications common to both gastric and duodenal ulcer, due also to cicatrizing or citatrized ulcer, dilatation of the stomach was found by Collin[7] 18 times in 262 cases.

The complication, at once the gravest, and the frequency of which most difficult to estimate with accuracy, is perforation into the general peritoneal cavity. Percentages estimated from published cases are manifestly very misleading, as perforation has been the feature which has led to the report of many cases. In Collin's[7] 262 cases, published in 1894, and believed by him to include all cases of simple duodenal ulcer reported since 1823, perforation occurred in 181 (sixty-nine per cent.). In the cases collected by me, comprising

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all cases recorded from 1894 to the present date, 54 in number, perforation occurred in 44.

Many of these cases have been reported by surgeons on account of the existence of perforation and with the view of eliciting discussion as to the feasibility of operation. The statistics of unselected cases must, therefore, serve as the basis for an estimate of the frequency of perforation. Among the large number of full post-mortem records previously referred to, the only ones available for such a purpose are those of Perry and Shaw[1] and of the Presbyterian Hospital. In the 1,124 autopsies at the Presbyterian Hospital from 1893 to 1900, duodenal ulcer was present in four cases (0.35 per cent.), and perforation existed in two of these. Including the fatal case in which the lesion was discovered at operation, the percentage of perforations would be sixty per cent. On the other hand, in Perry and Shaw's[1] 70 unselected cases of duodenal ulcer, perforation was present in only 8 (eleven per cent.).

The comparatively small number of autopsies in the Presbyterian Hospital records may be regarded as militating against their acceptance as a correct basis for estimation, although the ratio of cases of duodenal ulcer to the total number of autopsies almost exactly coincides with that of the Guy's Hospital statistics. If Perry and Shaw's[7] percentage is even approximately correct, the frequency of perforation into the peritoneal cavity is nearly twice as great as has been estimated in the case of gastric ulcer.

My inference from all available data coincides with that of Welch[19] who estimates the frequency of perforation in gastric ulcer to be about 6.5 per cent.

It is of much interest to note that in 104 cases of Collin, where the site of the perforating ulcer is specified in 69 instances it was on the anterior wall of the duodenum, and in 35 on the posterior wall.

Varied opinions are held as to the possibility of the clinical differentiation of duodenal from gastric ulcer. Nothnagel, Leube, Ewald and Collin believe that it is impossible in the majority of cases, in opposition to the views of Chvostek, Bucquoy, Burwinkle, Boas, and Weir, among others. My personal experience is in accord with that of the former observers. The general opinion that severe gastric or intestinal symptoms are rarely observed in duodenal ulcers is based upon the apparent absence of symptoms in many instances until perforation suddenly occurs. My experience leads

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me to believe that such a latency is more apparent than real, and that a careful study of these cases would reveal the antecedent existence of well-marked symptoms.

Burwinkle believes that in all cases careful investigation would show a history of more or less prolonged disturbance of digestion.

In 51 cases of perforating duodenal ulcer collected by Weir and Foote up to April, 1900, embracing all reported cases that had undergone operation, there was a history of previous gastric or intestinal symptoms in 25 out of 34 instances in which this point was noted.

Among the subjective symptoms the character of the pain in no wise differs from that of gastric ulcer.*

It is described by patients as burning or boring. *The relation* of the epigastric pain, if present, to the ingestion of food is believed by some observers to be a symptom of differential diagnostic value. They claim that in duodenal ulcer, cessation of the pain which is often present two or three hours after a meal occurs on the further ingestion of food. The explanation of this feature is found by Chvostek[21] and Burwinkle[22] in the closure of the pylorus through the irritation of food, thus preventing further irritating material from passing into the duodenum. In the cases which have come under my observation where a duodenal ulcer was found at autopsy, the more or less constant character of the pain, even when the stomach has been empty, has been a more conspicuous symptom, in marked contrast to the clinical history of gastric ulcer.

Among the objective signs, little or no assistance is given by the examination of the gastric contents. Both hypochlorhydria and increased acidity have been observed. A painful pressure-point, situated to the right of the median line between the umbilicus and the costal arch, when present, is a sign of some value. Boas[9] has observed in several cases a painful dorsal point to the right of the twelfth dorsal vertebra.

In uncomplicated duodenal ulcer, *à priori*, vomiting would not be expected. My experience has been that it is a frequent symptom. When not due to the reflex irritation of pain, the not infrequent accompanying gastritis and the occasional gastric ectasia from cicatrizing ulcers are probable factors in its causation.

* Chvostek has reported 8 cases; Bucquoy, 5 cases; Burwinkle, 5 cases; Weir, 5 cases.

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A careful study of the clinical histories of a large number of cases leads me to believe that the character of the vomited matter is of slight diagnostic value. Ewald [23] relates a personal case in which the vomited matter consisted of three totally different parts; first the food in the stomach was vomited, then bile, and finally blood. Such characteristics can be presented only occasionally.

The form of the hemorrhage, if present, is of slight differential value, in my experience. In small hemorrhages in duodenal ulcer, undoubtedly the blood passes by the bowel and escapes notice; in copious hemorrhage, the clinical histories of the cases which are appended indicate that it may appear indifferently in the form of hæmatemesis or melæna, or both.

The prognosis in simple ulcer of the duodenum is variously regarded by different observers. Bucquoy [24] believes that it is of great gravity. Oppenheimer [25] that cicatrization seldom occurs, is mostly incomplete, and that the prognosis is always grave. Ewald considers the prognosis unfavorable. He believes that the tendency is toward deep ulceration and its attendant consequences; if healing occurs, that the cicatrices are rarely smooth and lead to contraction and stenosis. Boas, on the contrary, claims that the prognosis is more favorable than in gastric ulcer, if the danger of perforation is excepted.

The statistics previously quoted indicate that on the most conservative estimate the frequency of perforation is nearly twice as great as in gastric ulcer.

No more than an approximate estimate of the frequency of cicatrization in duodenal ulcer is possible. In the 70 cases of Perry and Shaw,[1] cicatrization was present in 8 instances, eleven per cent. Kraus [26] observed cicatrization only twice in 80 cases. In Collin's [7] 262 observations, cicatrized ulcers were found 23 times, 8.7 per cent., and ulcers beginning to heal in 5 instances, 1.9 per cent. It is probable that the highest percentage given is considerably below a correct estimate, as cicatrices of the duodenal mucous membrane undoubtedly frequently escape observation.

The chief features of the seven cases whose clinical histories are related, may be briefly analyzed:

Six of the cases were males, one a female. The ages were: thirty-eight (female), forty, thirty-four, forty-two, twenty-five, thirty-four, and thirty-four, respectively.

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In Cases II. and V. there was a history of an excessive alcoholic habit, and the development of the fatal attack occurred during a period of excessive drinking.

In Cases III., IV., and VI. a moderate alcoholic habit was present.

In six of the seven cases, digestive disturbances had existed for very considerable periods, five months to many years. In Case III. there had been a severe attack, similar in many respects to the fatal illness, six years previously.

Pain.—In Case I. acute pain was felt only four days before death. It was located to the right of the umbilicus. Undoubtedly it immediately preceded perforation.

In Case II. severe epigastric pain first occurred eleven days before death. It was constant. It was not localized, beyond being confined to the epigastrium. There was sensitiveness on palpation, especially marked in the right half of the epigastrium.

In Case III. little if any abdominal pain accompanied the digestive disturbance present before admission to hospital. During the five months of residence in hospital, there was almost constant epigastric pain and of a severe character. It was present irrespective of the ingestion of food, even during the periods of rectal alimentation. There was slight diffused epigastric sensitiveness.

In Case IV. epigastric pain had been present throughout the course of the illness of two years. Its relation to the ingestion of food was not determined. After admission to hospital and during the period of eight days before death, it was constant and severe. There was marked sensitiveness on palpation over a circumscribed area to the right of the median line opposite the ninth costal cartilage.

In Case VI. the course of the ulcer was a latent one, there being no symptoms beyond comparatively slight hæmatemesis which occurred after admission to hospital and which was ascribed to other causes.

In Case VII. the epigastric pain was constant and little affected by the ingestion of food during the two months of the fatal illness. There was diffused epigastric sensitiveness.

Vomiting.—In Case I. vomiting had been a frequent symptom with an undetermined relation to the ingestion of food during the long period of digestive disturbance. The vomiting shortly before admission to the hospital, probably, immediately preceded perfora-

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tion. In this case it is of interest that open and cicatrized gastric ulcers in addition to the duodenal ulcers were present.

In Case II. acute attacks of vomiting had occurred in the past during periods of excessive drinking. They were stated to be independent of the ingestion of food. Vomiting was present throughout the period of the patient's last illness.

In Case III. there had been more or less vomiting from the beginning of the illness. It variously occurred in the morning before breakfast and an hour to an hour and a half after meals. It persisted until death.

In Case IV. vomiting had been a symptom throughout the illness of two years.

In Case V. the history of "alcoholic gastritis" would indicate the probable occurrence of vomiting.

In Case VII. vomiting occurred directly after the ingestion of food of any kind during the last several weeks of illness.

Hemorrhage.—In six of the seven cases there was no history of hæmatemesis or melæna previous to admission to the hospital. In the remaining case (Case I.) hæmatemesis had not occurred, but tarry stools had been noticed on several occasions, three weeks previous to admission; and grumous material was vomited and passed by the bowel twenty-four hours before death. In this case the open gastric ulcer found at autopsy, and which had probably existed for a considerable period, had not been attended with hæmatemesis.

In Case II. profuse hæmatemesis occurred, but no melæna.

In Case III. hæmatemesis and melæna occurred with about equal frequency during a period of five months.

In Case IV. the first hemorrhage occurred eight days before death, in the form of melæna followed by several dejections of fluid blood on the same day. On the following day twenty-five ounces of blood were vomited, but none was passed by the bowel. In the succeeding twenty-four hours thirty ounces of blood were passed by the bowel, but there was no hæmatemesis.

On the succeeding days until death the hemorrhage was in the form of melæna only.

Case V. was moribund on admission to hospital.

In Case VI. there was hæmatemesis, but no melæna.

In Case VII. neither hæmatemesis nor melæna occurred at any time. The absence of hemorrhage in this case is noteworthy, as

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the duodenal ulcer found at autopsy was of large size (an inch and a half in diameter) and had extended to the serous coat.

In four of the cases death was due to perforation, in one to hemorrhage and inanition, in one to inanition.

In two of the cases the heart was found to be normal at autopsy; in two in which a complete autopsy was not permitted, physical examination during life gave negative evidence of cardiac disease; and in three, endocarditis existed, with mitral valve vegetations present in two of them.

In three of the cases the kidneys were practically normal; in two, in which the kidneys were not examined, the urinary examinations during life were negative; in one, chronic nephritis was present; and in one, slight renal changes existed.

Other pathological conditions noted were advanced fatty changes in the liver in a single case.

In one case healed and open gastric ulcers coexisted with the duodenal ulcer. In six of the cases, a single duodenal ulcer was present, in one case, two ulcers.

In three of the cases the site of the ulcer was on the anterior wall; in one, on the posterior wall; in three, the site was not recorded.

Case I.—Female; aged thirty-eight; admitted to hospital January 18, 1899. Service of Dr. Andrew H. Smith.

Clinical Diagnosis.—Perforating peptic ulcer, general peritonitis.

Family History.—Unimportant.

Previous History.—For many years the patient has suffered from time to time from indigestion, and has had attacks of vomiting that apparently have not had much relation to the taking of food. She has not suffered acute pain with these attacks, and has never vomited blood. Three weeks ago she passed tarry-looking matter several times in her dejections. With these exceptions she was well until four days ago.

Present Illness.—Began four days ago suddenly with acute pain situated just to the right of the umbilicus. The patient also vomited several times, but there was no blood in the vomited matter. Her temperature the following day was 102, and the abdominal pain was slightly more diffused, but there was no vomiting. She was given Epsom salts, and her bowels moved several times. The tempera-

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ture subsequently fell to 99.5°. Last evening, the third day of the illness, the pain became more severe and diffused, and she began to vomit a dark grumous material. She also passed, by the bowels, a large amount of a similar material. The vomiting and purging continued, and this morning the patient felt very weak and prostrated, but the pain was not so severe. The patient was brought to the hospital in a carriage.

January 18. Physical examination on admission: The patient is moderately well nourished, slightly cyanosed, and anæmic. The tongue is moist and heavily coated with a brownish fur. There is constant vomiting of a dark grumous material, without odor. Heart: The apex is in the fourth space within the mid-clavicular line. Its action is very feeble and rapid, the sounds are indistinct. No murmurs are appreciable. Lungs: Negative. Liver: Area of normal dulness obliterated by abdominal tympany. Spleen: Not made out. Abdomen: Is distended, with rigid walls. Percussion is everywhere tympanitic except in right hypochondriac and lumbar regions, where the note is dull. Over these regions and in the hypogastric region there is marked tenderness on palpation. In the upper right quadrant of the abdomen there is an indefinite sensation of a mass on gentle palpation. Pulse, 140; temperature (rectal), 104°.

The patient rapidly failed, and died five hours after admission, the temperature rising to 105° immediately preceding death.

Autopsy. — Anatomical Diagnosis: Perforating ulcer of duodenum, gastric ulcer, general septic peritonitis. Heart: Valves normal, muscle normal. Lungs: There is considerable recent fibrin over the lower portion of both pleural membranes. On section, both lungs congested and œdematous. Peritoneal Cavity: Contains a large amount of thin dark fluid from stomach and duodenum. Intestines adherent to each other and to the abdominal wall by fresh fibrino-purulent exudate. Liver: Consistence, very soft. Pale in color. Surface covered with fibrino-purulent exudate. Gall-bladder full of greenish bile. Spleen: Consistence firm, color dark, considerable fibrous thickening of capsule. Kidneys: Left; capsule free, surface slightly roughened, on section, a little opaque, markings irregular in places and indistinct in other areas; cortex, slightly uneven in thickness. Right; capsule adherent in places, otherwise the same as left kidney. Microscopic Examination: Slight increase in connective tissue. Considerable degeneration of the tubal epithelium, considera-

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ble *débris* in tubes. Pancreas: Normal. Stomach: On the posterior wall of the lesser curvature is an area thinner and more fibrous than the other portions of the stomach walls, covered by a thin and adherent mucous membrane, in the centre of which is a cup-shaped depression, apparently the site of a cicatrized ulcer. Near the greater curvature are two ulcers, close together, each about one-third of an inch in diameter, the mucous membrane presenting the characteristic "punched out" appearance. Duodenum: Just beyond the pyloric ring, on the anterior aspect of the duodenum, is a perforation two-thirds of an inch in diameter. The wall of the duodenum at this point is thickened and hard to the feel, and the edges of the ulcer are smooth and rounded. The peritoneal coat appears to have recently ruptured; it is ragged, sloughing, and blackened around the edge of the opening.

Case II.—M.; male; aged forty; admitted to hospital January 10, 1899. Service of Dr. Kinnicutt.

Clinical Diagnosis.—Perforating peptic ulcer.

Family History.—Unimportant.

Previous History.—Patient has used alcohol to excess for years prior to a year ago. For the past year, until two weeks ago, he has been an "abstainer." He has had gonorrhœa, but not syphilis. There is a history of digestive disturbance extending over a period of thirteen years, characterized by occasional acute attacks of vomiting similar to the present one, and by more or less constant flatulence after meals. The last acute attack occurred July, 1898, but was only of ten days' duration. Prior to this, he had had no attack for eighteen months. The attacks usually followed a period of excessive drinking. There was never any blood in the vomited matter or in the stools, so far as patient knows.

Present Illness.—Began a week ago. The patient had been drinking to excess for a few days previously. He has suffered from loss of appetite, nausea, and vomiting independently of the ingestion of food during this period. There has been no blood in the vomited matter. There has been very constant epigastric pain, at times very acute and radiating over the abdomen. The bowels have been constipated.

Examination on Admission.—The patient is well nourished, and is not anæmic. The tongue is moist, but thickly coated with a yellowish fur. Thorax: Lungs, negative. Heart, negative. Liver:

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Percusses from the sixth rib to an inch below the costal arch in the mid-clavicular line, where the edge is palpable. Spleen: Edge not palpable. Abdomen: Not distended. It is slightly more prominent in the right epigastric region; over this area there is a slight rigidity of the muscles, and there is much sensitiveness on palpation over the whole of the epigastrium. On deeper palpation, a mass can be felt in the right epigastric region, which seems to be continuous with the liver. Its lower border, however, cannot be palpated, and its nature is considered doubtful. The remainder of the abdomen is normal in appearance, and is everywhere normal on palpation. Pulse, 96; temperature (rectal), 100° F.; urine, negative.

Aside from the doubtful physical signs described, the clinical history and the physical examination suggested the existence of an acute gastritis, the result of a period of excessive drinking.

Poultices were directed to be applied over the epigastrium, and small portions of peptonized milk, and milk and barley-water, to be given at frequent intervals.

During the three following days the patient's condition remained much the same. There was more or less vomiting after the ingestion of food, but the vomited matter consisted only of the fluids taken. Vomiting also occurred independently of food-taking. The tenderness over the epigastrium persisted, but was confined to this region. The epigastric prominence increased, but was never very marked, and the mass felt larger. The abdomen elsewhere was normal in appearance and on palpation. The temperature curve was irregular. On the 11th the temperature was 102° F. (rectal) in the morning, receding to 99.5° in the evening. On the 12th it was 100° in the morning, 102° in the evening. On the 13th the morning temperature was 99.2°, the evening 101.5°. The bowels were moved by enemata.

On the evening of the 13th, the third day after admission, the patient vomited a small quantity of a suspicious-looking fluid, slightly brownish in character. Physical examination revealed a marked and comparatively rapid increase in the mass in the epigastric region. Its lower limit was palpable nearly at the umbilicus in the median line, and at this level extended to the right to a point midway between the para-sternal and mammillary lines.

It was firm but not hard to the feel. The sensitiveness was still confined to the epigastrium and to the area of the palpable mass.

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The remainder of the abdomen continued to be normal in appearance and on palpation. In view of the rapid increase in the size of the mass, its situation, and the character of the vomited matter, the existence of a perforating ulcer with escape of the gastric contents into a cavity formed by adhesions or into the lesser peritoneal cavity displacing the stomach was considered probable, and a surgical consultation was asked.

During the night the patient was very restless and at times delirious and vomited at intervals of two to three hours from two to four ounces of a fluid containing a small quantity of blood altered by the gastric secretions. Suddenly, between six and seven o'clock in the morning, forty-eight ounces of fluid blood and a considerable number of largish blood-clots were vomited. The temperature rapidly fell to 96.5° and the pulse rose to 140. The abdomen presented no signs other than those described.

Under continuous intestinal irrigation with a normal salt solution at a temperature of 115°, and active stimulation with whiskey, nitroglycerin, and strychnine, given hypodermatically, the patient rallied sufficiently at the end of six hours to justify, in the opinion of my colleague, Dr. McCosh, the attempt to open the abdomen with the hope of finding and closing the probable ulcer. The patient was rapidly anæsthetized, and the abdomen opened. The stomach and liver were partially adherent. On drawing the stomach downward, a very large amount of fluid and clotted blood was found in what appeared to be the lesser peritoneal cavity. The stomach was rapidly opened and was found to be full of blood; the amount was estimated at more than a litre. A circular ulcer, about two inches in diameter perforating the peritoneal coat, was discovered on the posterior wall of the duodenum, just below the pyloric ring. The patient's condition was such that it was impossible to proceed further with the operation, and death occurred a few moments later.

An autopsy was not permitted.

Case III.—Male; aged thirty-four; mechanic; Canadian; admitted to the hospital January 12, 1899. Service of Dr. Andrew H. Smith.

Family History.—Unimportant.

Previous History.—Inflammatory rheumatism five years ago. Venereal disease denied. There has been a moderate alcoholic habit. There is a history of gastric symptoms, very similar to those present

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during the past five months, six years ago, from which he recovered.

Present Illness.—Five months ago he began to be troubled with eructations of gas and sour fluid from time to time, with vomiting occasionally on rising in the morning, also often an hour to an hour and a half after the ingestion of food. There was accompanying constipation, loss of weight and strength. There was apparently little if any abdominal pain. These symptoms have persisted up to the present date.

On admission: the patient is fairly well-nourished, is not anæmic in appearance. Pulse, 74, of good force; temperature, 100.3° F., mouth.

Physical Examination.—Negative, with the exception of eliciting slight epigastric tenderness on palpation. Urine: 1027, acid, no albumin, sugar, or casts. Much gastric pain is present irrespective of the ingestion of food. There were no other symptoms beyond the vomiting of undigested food on January 15 and January 18 until January 19, when there were several slight syncopal attacks which were followed on the next day by a large tarry defecation and later by vomiting of rather a large amount of altered blood. Vomiting of a similar character and melæna occurred on the 20th, 21st, 24th, and 25th. All feeding by the mouth had been discontinued on the 20th, and rectal alimentation instituted. The epigastric pain persisted during the period of rectal feeding and necessitated the use of hypodermic injections of morphine. It was found impossible to continue the rectal alimentation beyond the fifth day, and small feedings of peptonized milk were substituted. The symptoms were not materially affected by the change; and from this date, throughout a period of four and a half months, the clinical history was that of irregular but frequent attacks of hæmatemesis, always of a grumous character, and melæna, severe epigastric pain irrespective of the ingestion of food, vomiting, marked cachexia, a hæmoglobin percentage as low as twelve at times, progressive loss of weight and strength, and an irregular temperature curve, rarely rising above 101° F. Physical examinations during this period never revealed other signs than the epigastric tenderness on palpation, present on admission, and during the last days of life, fluid in the left pleural cavity. Various forms of fluid diet were given, and from time to time rectal feeding alone was employed

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and persisted in until rectal irritability compelled its disuse. The gastric contents were not examined, as it was considered unwise to introduce the stomach-tube. Death occurred on June 17, five months after admission to the hospital, from asthenia without the development of other symptoms than those described.

Autopsy.—Anatomical Diagnosis: Ulcer of duodenum, adherent pleura (right lung); left hydrothorax. Heart: Valves normal in appearance and on section. Lungs: Left lung free from adhesions. The pleural cavity contains 300 c.c. of clear serum. Upper lobe, emphysematous, lower lobe, œdematous. Right lung, a few old adhesions. Liver and Spleen: Normal in appearance and on section. Kidneys: Right, weight four and one-half ounces; left, weight five ounces. Capsules free, surface smooth; on section, markings slightly indistinct. Histological Examination: There is a very slight degeneration of the tubal epithelium, and a little granular *débris* in tubes. Stomach: Slight congestion of mucosa, otherwise normal. Intestines: In the duodenum, immediately beyond the pylorus, is an ulcer, round, with smooth edges, three-quarters of an inch in diameter, its base being formed by the head of the pancreas. Pancreas: The head is adherent to the upper portion of the duodenum, forming the floor of the ulcer.

Case IV.—Male, aged forty-two; carpenter; Germany; admitted to the hospital December 26, 1897. Service of Dr. Kinnicutt.

Clinical Diagnosis.—Ulcer of duodenum.

Family History.—Not obtained.

Previous History.—No specific history. Alcoholic habit at one time, but not of late. Inflammatory rheumatism twelve years ago. Pneumonia four years ago.

Present illness began about two years ago with symptoms of digestive disturbance (gastric flatulence, occasional vomiting, distress and pain in upper abdomen). The most marked symptom was the abdominal pain. His statements in regard to any apparent dependence of the epigastric pain upon the ingestion of food are very uncertain. The vomiting was principally of mucus; there was never any blood in the vomited matter. The bowels have been constipated throughout his illness, and there has never been any blood in the stools.

These symptoms have been sufficiently troublesome to prevent any continuous work during the two years previous to admission.

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During the past several weeks all the symptoms have been much worse; the vomiting has been more frequent and the epigastric pain more severe.

Last evening the pain became very acute, radiating from the epigastrium into either side. This morning there was a large dejection consisting almost entirely of dark blood. On attempting to walk to the hospital dispensary, he fell in the street and was brought to the hospital in an ambulance.

Examination on Admission.—The patient is well nourished. There is marked pallor of skin and mucous membranes. Heart; Apex in the fifth space, three and one-half inches from the median line. Sounds distant, no murmurs appreciable. Lungs: Practically negative. Liver and spleen: Areas of dulness, normal, edge of neither palpable. Abdomen: There is marked sensitiveness on palpation over an area not larger than a silver dollar, in the epigastric region, to the right of the median line opposite the ninth costal cartilage. Over and about this area there is a marked sense of resistance, but no distinct mass can be made out. Abdomen otherwise normal in appearance and on palpation. Urine: No albumin, sugar, or casts. Hæmoglobin thirty-six per cent. Temperature, 100.5° F. Pulse, 124, small and of little force. Radials slightly thickened. There was a large dejection of dark red blood a few hours after admission, and a second similar one four hours later. On the following morning, December 27, signs of internal hemorrhage were suddenly developed; there was extreme pallor, sweating, an almost inappreciable pulse, gasping respiration, and an epileptiform convulsion. In the subsequent few hours, twenty-five ounces of dark blood was vomited at different times, but melæna did not occur.

December 28. Thirty ounces of dark blood were passed by the bowel at different periods, but there was no hæmatemesis.

December 29. There was a single tarry dejection. No hæmatemesis. Red cells, 1,640,000; white, 12,000.

December 30. The patient complained of much epigastric pain and there were two tarry dejections.

December 31. No hæmatemesis, no melæna. The patient complains of soreness over the right parotid.

On January 1 and 2 there were numerous tarry stools and dejections of fluid blood. The patient had several epileptiform seizures.

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On January 1 red cells, 1,280,000; white, 26,000. There was appreciable swelling of the right parotid.

On January 3 death occurred following copious melæna. The temperature, except for a few hours following the collapse on the 27th, when it fell to 99° F., was continuously above normal (100–102°).

Autopsy.—Anatomical diagnosis: Chronic endocarditis, adhesive peritonitis, ulcer of duodenum. Lungs: A few light adhesions over base of both lungs. Heart: The mitral curtains are thickened and show a few small vegetations. Liver: Consistence, firm; surface smooth, section a little pale; weight forty ounces. Spleen: Surface normal, normal in consistence, and on section; weight eight ounces. Gall-bladder: Full of very dark bile. Kidneys: Normal in appearance and on section; microscopic examination, practically negative. Adrenals: Normal in appearance and on section. Pancreas: Adherent at head to duodenum, otherwise normal in appearance and on section. Stomach: The mucosa is normal in appearance. Peritoneum: There are very firm adhesions between diaphragm and upper surface of liver. There are also firm adhesions between duodenum and under surface of liver. Duodenum: There in an oval ulcer one and one-quarter inches in diameter, the upper edge of which is a half inch below the pyloric ring. Its edges are abrupt and the floor is formed by the adherent head of the pancreas. In the floor of the ulcer is seen an opening into an eroded artery of large size. Intestines: Otherwise normal throughout their extent.

Case V.—Male, aged twenty-five; bartender; admitted August 5, 1893. Service of Dr. Thompson.

The patient was brought to the hospital in an ambulance, with the sole history of two days' alcoholism and bowel disturbance(?).

It later was learned that he had been at work on the day previous to admission, and had suffered for an indefinite period from an alcoholic gastritis(?). The patient had a convulsion in the reception-room and was immediately sent to the wards.

Physical Examination.—The patient is in a state of profound collapse. Heart action very rapid and feeble, pulse almost imperceptible. Temperature (rectal), 104.8° F. The abdomen is tense and painful. Further examination was impossible, as the patient was moribund and died a few moments later.

Autopsy.—Anatomical diagnosis: Chronic endocarditis, per-

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forating ulcer of the duodenum, septic peritonitis. Heart: The mitral valve is thickened and presents a few small vegetations. The other valves are normal. Muscle normal in appearance and on section. Weight, eleven and one-half ounces. Lungs: Normal, beyond a few old adhesions of right pleura and a moderate degree of congestion of both lungs. Peritoneal cavity: Contains 1,000 c.c. of sero-pus, with a considerable amount of fibrino-purulent exudate. Stomach: The mucous membrane appears to be slightly thickened, otherwise normal. Intestines: Duodenum: There is a perforating ulcer one-half inch in diameter in the anterior wall at the junction of the duodenum with the pylorus. Intestines otherwise normal. Liver: Surface smooth, color pale, consistence firm. On section very pale and fatty. Weight, 104 ounces. Gall-bladder: Contains a small amount of brown bile. Spleen: Surface normal, on section normal. Pancreas: Normal. Kidney: Left, weight five and one-half ounces. Right, weight six ounces. Capsules non-adherent. Surface smooth. On section, striæ a little indistinct. Histological examination: Slight degeneration of the cells of the convoluted tubes. Brain: Membranes normal, substance normal.

Case VI.—Male, aged thirty-four; Canadian; tradesman; admitted to St. Luke's Hospital April 9, 1885. Service of Dr. Wheelock.

Family History.—Unimportant.

Previous History.—Never any acute illness, and never any rheumatic symptoms. Formerly a moderate alcoholic habit. Ten years ago a venereal sore and suppurating buboes. The patient denies other specific history.

Present Illness.—Insidious onset. The patient worked until three months ago, but for some time previous had suffered from occasional faintness, dyspnœa, and palpitation on slight exertion, and slight swelling of the feet. From time to time there were attacks of almost incessant vomiting for a period of twenty-four hours, but there was no blood in the vomited matter (uræmic ?). Beyond this symptom there was apparently an absence of gastric disturbance. He has been troubled with frequent micturition and occasionally there has been difficulty in passing urine. In the past three weeks he has expectorated frequently a small amount of bright red blood. There has been a progressive loss of weight and strength.

Physical Examination on Admission.—Heart. The apex is one and one-half inches to the left of the mid-clavicular line. There is a

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double rasping murmur over the aortic area; the diastolic murmur is also heard at the apex. There is also a systolic murmur over the mitral area and accentuation of the pulmonic second sound. Lungs: There are the physical signs of fluid in the right pleural cavity. There is no ascites, but a moderate general subcutaneous œdema. Pulse, 92 (Corrigan's). Temperature, normal. Urine: Specific gravity, 1.008; albumin, a trace; no sugar. The examination shows a considerable amount of pus.

From the date of admission until April 30, when death occurred, there were frequent hæmatemeses, some of them being of considerable amount. No blood was passed by the bowel. The anasarca gradually increased, signs of rapidly accumulating fluid in the peritoneal cavity were present; but at no time were there any symptoms of collapse, and death occurred apparently as the result of the cardiac lesion.

Autopsy.—Anatomical diagnosis: Perforating duodenal ulcer, general peritonitis, cardiac hypertrophy and dilatation, aortic insufficiency, chronic diffuse nephritis, renal calculus. Heart: Left ventricle hypertrophied and dilated; muscle pale, soft, and contains a good deal of fat. Two segments of the aortic valve are agglutinated, forming an imperfect segment. There is stenosis with insufficiency. Weight, sixteen ounces. The mitral valve is normal with the exception of a calcareous deposit at its base. The other valves are normal. Lungs: The right pleural cavity contains twenty-four ounces of clear serum. Both lungs contain a number of infarcts. Peritoneal cavity: Contains 136 ounces of bile-stained serum and considerable recent plastic exudate. Stomach: Normal. Duodenum: There are two ulcers in the wall of the duodenum, one irregularly oval in shape and involving the entire thickness of the mucosa, the second circular in contour and communicating with the peritoneal cavity by an opening one-eighth inch in diameter. Kidneys: Section shows the presence of a chronic diffuse nephritis. There is a calculus in the pelvis of right kidney.

Case VII.—Male; aged thirty-four. Personal Case.

Family History.—Unimportant.

Previous History.—There is no alcoholic or specific history. There has been an abuse of tobacco at different periods from boyhood. Digestive disturbances of unusual severity have been present at various times from early youth. They have consisted of

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attacks of acute epigastric pain increased by the ingestion of food and always partially or wholly relieved by vomiting. The attacks were of varied duration. Periods of several months of suffering would be followed by intervals of relief of a corresponding or longer duration. Neither hæmatemesis nor melæna occurred at any time. An inordinate craving for "sweets," and an indulgence of the taste, has existed for many years. For six months previous to the beginning of his present illness comparative good health has been enjoyed. A pound of confection has been consumed daily by the patient for the latter three months of this period. A month before the patient came under observation, severe epigastric pain began to be experienced. The pain was constant, being neither increased nor diminished by the ingestion of food. Gradually vomiting followed directly the taking of food of any kind. Hæmatemesis never occurred, and blood in the stools was never detected.

The patient came under my care suffering from the symptoms described. He was greatly emaciated. Physical examination of the various organs failed to elicit any evidence of disease. The urinary examination was negative. Although severe epigastric pain was complained of, a painful pressure-point was absent and general epigastric sensitiveness was not marked. The epigastric pain was constantly present and apparently was little affected by the ingestion of food, which at first the patient was able to take, although vomiting was frequent. Speedily vomiting occurred directly on the taking of food of any kind. Lavage was employed without effect. Finally it was impossible to feed the patient otherwise than by the rectum. During the period of rectal alimentation the pain persisted, but was somewhat ameliorated. Hæmatemesis never occurred, and, although the stools were systematically and carefully examined, the presence of blood was never detected. There was continuous and rapid loss of strength and weight. The patient refused to permit any attempt to relieve his condition by operation. The emaciation finally became extreme, and death resulted from inanition at the end of the fourth week.

Only a partial autopsy was permitted.

The stomach was examined *in situ*, and no open ulcer was discovered. From the clinical history it is probable that cicatrices of healed ulcers existed. Dilatation of any marked degree was absent.

The duodenum was firmly adherent to the under surface of the

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liver in such a manner as to cause a partial stenosis of its first portion. On the anterior wall about an inch from the pylorus there was a round ulcer, an inch and a half in diameter, with thickened, indurated, and abrupt edges, the floor being formed by the serous coat.

A further examination was not permitted.

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III.

SOME UNUSUAL CASES OF IRREDUCIBLE AND STRANGULATED HERNIA.

By Ellsworth Eliot, Jr., M.D.

I. IRREDUCIBLE HERNIA.

Very few cases of either inguinal or femoral hernia in the adult develop without the knowledge of the patient. Either the swelling itself is accidentally noticed, or the attention of the patient is directed to the hernia by the development of local pain or of dragging sensation in the affected part. Exceptionally, in the absence of these subjective symptoms, the physician is consulted on account of indigestion, and examination of the hernial regions discloses the presence of the rupture.

There are occasional cases, however, of both inguinal and femoral hernia, in which the condition is recognized for the first time only after a condition of irreducibility has developed, and in which, in the absence of the characteristic history of previous reducibility, the diagnosis may be especially difficult; particularly is difficulty experienced in distinguishing such cases of femoral herniæ from enlarged and inflamed lymphatic glands around the saphenous opening. In the inguinal variety, on the other hand, a similar condition may be confused with a neoplasm of the cord.

The failure of these herniæ to attract the attention of the patient during the reducible stage is probably due to the fact that owing to their small size they are easily concealed from view by the surrounding adipose tissue (frequently deposited in generous quantities in both the inguinal and femoral regions), as well as to the fact that, being invariably epiplocele, they do not generally cause any intestinal disturbance. When they become irreducible, however, the irritation to which the omentum is subjected causes pain, with occasionally other symptoms of inflammation, and the presence of the "lump" is quickly detected by the patient.

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Histories of cases illustrating this condition follow.

Case I. Irreducible Inguinal Hernia.—Male, aged fifty-eight; previous history negative. Patient has never engaged in laborious work.

One week ago patient experienced for the first time a slight pain in the scrotum. In searching for the cause of the pain, a small, firm, elongated, and slightly sensitive lump was detected midway between the external ring and the testis.

It was about an inch in length and about half an inch in breadth. Its surface was slightly uneven, feeling like thickened fatty tissue. It was firmly fixed to the cord. No pedicle could be felt passing into the external abdominal ring. There was no impulse on coughing, and the size of the tumor remained the same from day to day irrespective of the position of the patient. Local applications of heat were advised, but at the end of a week the condition of the tumor was unchanged, save for a slight diminution in its sensitiveness.

Operation (Ether).—An incision parallel to the cord was made over the mass, and was gradually deepened until it was exposed to view. It was adherent to the cord, and there was no evidence of a sac. Search for a pedicle was then made, and a small one was found leading into the external ring. At this point, that portion of the sac to which the omentum was not adherent was identified. Its neck and cavity were small, being scarcely larger than necessary to accommodate the tongue of omentum, which it contained. The portion of the sac within the inguinal canal was then exposed, and after ligature of the omentum and the return of the stump into the abdominal cavity, the neck of the sac was tied with ordinary catgut at the level of the internal ring, and the operation concluded by the Bassini method. The wound healed *per primam*, and, three years having elapsed since the operation, no recurrence has taken place.

Case II. Irreducible Inguinal Hernia.—Male, aged thirty-six; patient engaged in light labor.

Previous history negative. Three weeks ago on rising in the morning patient noticed accidentally a small swelling in the left groin. It was free from tenderness, but patient suffered from "uneasiness" during the day. Since then, the swelling has not varied in size or position, although for the past week it has become moderately tender. At no time has the patient been unable to

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work. There have been no constitutional symptoms of fever or disturbances of digestion. Bowels moved yesterday before admission to the hospital, the movement being somewhat constipated.

Examination reveals the presence of a hard, dense tumor, situated about an inch below the external abdominal ring, the size of a walnut. It is fixed to the cord and moves up and down with the contraction of the cremaster muscle. When the patient coughs, an expansile impulse can be detected between the tumor and the ring and also over the inguinal canal, but none is present over the tumor.

At the end of four days, during which time the patient remained in bed with the hips elevated, no change had taken place in the character of the tumor, notwithstanding the application of flax-seed poultices.

Operation (Ether).—The swelling was exposed by an incision parallel to its long axis. From its stony hardness, it was first thought to be neoplastic. It was so firmly fixed to the cord that its dissection from the vas deferens was a matter of considerable difficulty. Further examination revealed the presence of a pedicle, extending into the inguinal canal, the hernial sac being opened opposite the external ring. After ligation and removal of the omentum, the sac was ligated opposite the internal ring and the operation concluded by the Bassini method.

The hard, firm mass of omentum which was removed was of a very dark, almost gangrenous color, and, notwithstanding its consistence, was evidently on the point of breaking down. Microscopic examination of the specimen showed evidences of chronic inflammation with, in places, a suspicion of possible tuberculosis.

Primary union was secured, and no recurrence has taken place up to the present time (four years after the operation).

Case III. Irreducible Femoral Hernia.—Male, aged twenty-three. Patient, a 'longshoreman by occupation, has always enjoyed good health. Three weeks ago, without known cause, patient first experienced rather sharp shooting pains in the right groin, which did not, however, interfere with his work. On examination a small mass, the size of an almond, was found opposite the saphenous opening. It was firm in consistence, having a smooth surface, and was freely movable, both beneath the overlying skin and on the deeper parts. It was slightly sensitive, and could not be diminished in size on pressure. There was no impulse. Notwithstanding rest in

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bed, with local application of heat, the condition of the swelling remained unchanged.

Operation (Ether).—The tumor was exposed by a vertical incision over the saphenous opening, and enucleated from the surrounding adipose tissue. A small pedicle was found passing through the saphenous opening into the crural canal. The tumor itself could not be separated from the hernial sac below the level of the saphenous opening. In the crural canal, however, the smooth lining membrane of the sac could readily be distinguished. The omentum was ligated and removed, the sac ligated with catgut, and the crural and saphenous orifices closed by chromic gut sutures. Primary union was obtained.

The patient was relieved by the operation, but has, since then, passed out of observation.

Case IV. Irreducible Femoral Hernia.—Male, aged twenty; 'longshoreman by occupation. The history of this case so closely resembles that of Case III. as to need no special description. The hernial protrusion, although no larger than a marble, presented the physical signs of a subacute femoral adenitis. There was no impulse on coughing. The diagnosis of an inflamed irreducible femoral epiplocele was substantiated by operation.

The absence of an impulse on coughing in several of these cases is explained by the fact that the orifice of the canal leading into the abdominal cavity was tightly plugged by the protruding omentum. Such lack of expansile impulse in hernia is regarded by many as almost pathognomonic of strangulation, an opinion which the cases just cited prove to be erroneous. It should also be noted that irreducible herniæ may temporarily lack impulse when the neck of the sac is tightly plugged with omentum, and that the impulse returns when, by any sudden movement or by manipulation, a portion of the omentum is dislodged and returned into the abdominal cavity.

Case V. Irreducible Inguinal Hernia.—The history of the following case is so exceptional as to warrant its report. Male, aged forty; a motorman by occupation. Patient has always enjoyed excellent health. About ten years ago, without known cause, patient first noticed a swelling in the left groin, which, on pressure, or on assuming the recumbent posture, would readily return into the abdominal cavity. For the past four years, however, the swell-

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ing, which has steadily increased in size, has been irreducible. Notwithstanding this fact, the patient has suffered no inconvenience, and desires operation, simply on account of the irreducibility.

Examination shows an oblique inguinal hernia on the left side, reaching half way down to the testis in the scrotum. In it there is a mass, the size of a small orange, having the consistence and other characteristics of omentum, which cannot be returned into the abdominal cavity. There is a distinct impulse on coughing.

Operation (Ether).—The hernial sac, exposed by an oblique incision, deepened through the anterior wall of the inguinal canal, and through the tissues of the scrotum, was found, on being opened, to contain a large mass of omentum, the extremity of which was very considerably thickened, evidently the result of chronic productive inflammation; for this reason, its return into the abdominal cavity was possible only after ligation of its base with a series of chain catgut ligatures, the stump, on account of its size, passing with some difficulty through the internal ring. After the insertion of the deep row of sutures between the edge of Poupart's ligament and the conjoined tendon, and after the thorough cleansing of the wound with normal salt solution, a marked venous oozing from the vicinity of the inner side of the internal ring was noticed. As this was persistent, it was thought to have been caused by a needle puncture of one of the deep epigastric veins. After several unsuccessful attempts, the bleeding point was apparently secured with a clamp and ligated with catgut. The external oblique and the overlying skin were then sutured in the usual way and the patient sent to the ward.

Two hours afterward, complete recovery from the effects of the anæsthetic not having taken place, the pulse became so weak that a saline infusion was considered advisable. The introduction of 800 c.c. of a normal salt solution into the median cephalic vein was followed by prompt restoration of the pulse to its normal tone. At the end of another hour the pulse again showed signs of weakness. There was also marked pallor of the lips and conjunctiva with some coldness of the extremities and general apathy. It was, therefore, deemed advisable, without further delay, to administer an anæsthetic, and, if possible, to determine the source of the probable hemorrhage, as indicated by the foregoing symptoms.

Operation (Ether).—An incision was made along the outer border of the rectus muscle below the level of the umbilicus and deepened

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until the peritoneal cavity was opened. There was no infiltration of any of the layers of the abdominal wall, but the peritoneal cavity was found to contain a considerable amount of blood in both fluid and freshly clotted condition. There was also considerable extravasation of blood between the layers of the mesentery of both the small intestine and the sigmoid. The omental stump was now drawn into the wound from the upper part of the abdominal cavity and the ligatures were found to be intact. The vicinity of the internal ring was then exposed by the retraction of the lower part of the laparotomy incision, and it was found that the ligature around the neck of the sac had not slipped, and that both deep epigastric veins were free from damage. The abdominal and pelvic cavities were then sponged out, and, after the removal of the blood, a small tear on the surface of the meso-sigmoid, involving a medium-sized tributary of the inferior mesenteric vein, was detected. It was about one-third of an inch in length, and was still bleeding, the blood passing not only into the peritoneal cavity, but also between the layers of the meso-sigmoid into extraperitoneal tissue as well. The rent was secured with a lateral ligature of catgut, the blood washed out as far as possible with a hot saline solution, and the abdominal incision closed, leaving a small tampon in the cavity of the pelvis, which was removed twenty-four hours later.

The patient made an uninterrupted recovery, both the hernial and the laparotomy wounds healing *per primam.*

Before the opening of the peritoneal cavity, the slipping of one of the ligatures in the omental stump, due to friction with the circumference of the internal ring in the return of the stump into the abdominal cavity, was considered to be the most probable source of the hemorrhage. The next most likely source of the bleeding was thought to be the possible needle puncture of one of the deep epigastric veins or even of the external iliac vein. The opening of the peritoneal cavity through an incision parallel to the outer border of the rectus muscle was considered more advantageous than the reopening of the hernial wound, as through it any of the foregoing forms of hemorrhage could be more quickly discovered and checked. Although none of these surmises was correct, the choice of the incision proved most fortunate in facilitating the detection of the bleeding point, the application of a ligature and the removal of the blood from the peritoneal cavity. It is scarcely necessary to add

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that none of these measures could have been successfully carried out through the reopening of the hernial wound.

The cause of the rent in the meso-sigmoid must remain a mystery. When the hernial sac was opened at the time of the first operation, its only contents were omentum. Neither the sigmoid flexure nor the meso-sigmoid was at any time visible. It is not improbable, however, that the meso-sigmoid was adherent to the parietal peritoneum in the vicinity of the internal ring, and that its separation from this point at the time of the reduction of the omental stump resulted in the tear. This view gains some confirmation from the fact that the omental stump was returned into the abdominal cavity with considerable difficulty.

2. STRANGULATED HERNIA. STRANGULATED HERNIA AT THE EXTREMES OF LIFE.

Case VI. Strangulated Inguinal Hernia.—Male, aged eighty-nine; referred to me by Dr. J. J. VanLoan.

Patient has had a reducible hernia for many years. About ten years ago it became strangulated, but yielded to taxis. With this exception the patient has always enjoyed excellent health, and the hernia has been retained in position by a truss.

Twenty-four hours ago the hernia descended behind the truss and could not be returned into the abdominal cavity. The patient experienced considerable pain with some vomiting. There was also hiccough. An attempt to reduce the hernia by taxis failed, and the patient was referred to me for operation.

On examination there is an irreducible oblique inguinal hernia on the left side extending into the scrotum almost to the testis. It is tense, elastic, and flat on percussion. There is no impulse on coughing.

Operation (Chloroform).—Another attempt to reduce the hernia by taxis proved fruitless. An incision was, therefore, made over the long axis of the swelling, and the hernial sac exposed. It was found to be distended with bloody, odorless fluid, and to contain a loop of small intestine about two inches in length. This could be reduced through external ring into that portion of the sac lying within the inguinal canal with some difficulty. The inguinal canal was now exposed and the cause of the constriction found to be the greatly

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thickened circumference of the internal ring. This was exposed by retraction and divided from without, permitting the reduction of the viable intestine. On account of the patient's advanced age, no attempt was made to suture the conjoined tendon to the shelving border of Poupart's ligament. The edges of the external oblique and of the skin were approximated with chromic gut and with silkworm gut, respectively.

The patient stood the operation very well without evidence of shock. The bowels moved on the following day, and the patient received and retained, without nausea, soft diet. The healing of the edges of the wound took place slowly, some gaping of the wound requiring the reinsertion of the stitches, although they were not removed until the tenth day. With this exception, the wound closed primarily.

The patient lived for four years after the operation, dying eventually of senility.

This case is noteworthy, not only on account of the advanced age of the patient, but also for the reason that it presents an example of a strangulated hernia of the "hour-glass" variety, for, although the constriction at the external ring was less than that of the internal ring, it was sufficient to have caused strangulation by itself. The case is also of interest clinically, because of the presence of hiccough. This symptom in connection with strangulated hernia is commonly regarded as significant of death of the contents of the sac. That it may sometimes develop when the intestine is still viable is well demonstrated by the case under discussion.

The cause of the constriction at both rings consisted in a thickening of the connective tissue immediately adjacent to their peritoneal margins. The division of these bands was accomplished from without, leaving the peritoneum undivided.

Case VII. Strangulated "Cæcal" Hernia.—J. B., aged ten weeks. The patient has had a scrotal hernia since birth. This has always disappeared with the infant in the recumbent position, until twenty-four hours before admission to the hospital, when, without known cause, the swelling became larger and irreducible. At the same time there were frequent attacks of vomiting, the vomitus consisting of the contents of the stomach; and continued crying indicated the presence of constant pain. The bowels had not moved for forty-eight hours.

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On examination, there is an irreducible inguinal hernia on the right side, extending half way down the scrotum toward the testis. It is very tense and painful and presents the usual features of strangulation. The overlying skin is discolored and the corresponding subcutaneous tissues are somewhat œdematous. Temperature, 100° F.; pulse, 140; respiration, 40.

Operation (Chloroform).—The inguinal canal was opened by an incision just above and parallel to Poupart's ligament. The constriction producing the strangulation proved to be the margin of the internal ring. The contents of the sac consisted of hemorrhagic serous fluid together with the appendix and the cæcum in a viable condition; the latter structure was supplied with the usual fœtal meso-cæcum, and the organ was quickly returned into the abdominal cavity after the division of the constricting band.

The operation was concluded in the usual way.

Post-Operative Course.—For several days after operation, the pulse varied between 140 and 160, becoming 120 on the seventh day. The highest temperature was 101.6° F., reaching normal about the tenth day. All vomiting ceased, and on the day after operation there were three dejections without catharsis. The wound healed *per primam.*

On bacteriological examination, the fluid in the sac was found to be sterile.

Six months after operation, the patient was in excellent condition.

Several other cases of recovery after operation for strangulated herniæ in infants, but several months older than the case just cited, might be reported in support of the fact that the mortality of this operation in infants is not necessarily high. Certainly the prognosis in this class of cases is very much better than in the internal forms of obstruction (principally invagination), which is probably due to the fact that the diagnosis of the hernia is very much more easy than that of the invagination, as well as to the fact that the operation for the relief of the latter condition usually requires more extensive handling of the intestine and is, therefore, followed by greater shock.

The degree of constriction in cases of strangulated hernia varies considerably. In cases of marked constriction, there is an exudation through the walls of the blood-vessels of both blood and serum

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into the cavity of the hernial sac. In less severe cases, the venous return, only, is impeded by the constriction, resulting in the exudation of serum into the hernial sac and in a moderate swelling and congestion of the parts subjected to strangulation. In both, necrosis of the intestine is inevitable, unless the constriction is relieved. Both groups of cases also exhibit similar symptoms, although their intensity as well as their rapidity of development depends upon the degree of constriction.

The two following cases illustrate the results of a moderate degree of constriction.

Case VIII. Strangulated Femoral Hernia. — J. M.; female, aged forty-nine. September 3, 1898, six months ago, while lifting, patient experienced the sensation of something "giving way" in the right groin, followed by the appearance of a swelling having the characteristics of a reducible hernia. The swelling became irreducible yesterday for the first time, the irreducibility being accompanied by several attacks of vomiting and by constipation. The swelling was not tender or painful. There was loss of appetite and great thirst.

In the left groin there is a swelling, moderately elastic, the size of a large walnut, over the region of the saphenous opening. There is no tenderness nor impulse on coughing. The abdomen is thin, slightly distended, and visible peristalsis is observed in the lower left quadrant. The patient's general condition is excellent. There is a small reducible femoral hernia on the opposite side.

After the patient's admission to the hospital, there was a cessation of the vomiting, and inasmuch as a fairly good action followed the usual enema, the hernia was thought to be of the "inflamed" variety, and operation was postponed until the local congestion should subside. The local condition, however, remained unchanged.

On the following day, the patient received and retained fluid nourishment. Examination revealed the presence of a slight impulse over the hernial tumor. Forty-eight hours after admission, however, the vomiting returned and longer delay was considered inadvisable.

Operation (Gas and Ether).—Vertical incision over the long axis of the tumor, deepened until the sac was exposed, the cavity of which contained a moderate amount of clear serum, free from odor. In the bottom of the sac a small portion of a loop of small

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intestine was found, tightly encircled by the margin of the femoral ring. It was of a dark mahogany color, but had not lost either its glistening appearance or its normal resiliency. The constriction was relieved by dividing the outer edge of Gimbernat's ligament, exposed by a dissection gradually deeped along the inner aspect of the neck of the sac. The intestine was then easily reduced into the abdominal cavity, the neck of the sac ligated with catgut, and the operation concluded in the usual way. The patient's condition being excellent, the hernia on the opposite side was exposed and treated by the "Bassini" method. Its sac was found to contain a considerable amount of clear serous fluid, evidently a portion of that which, in cases of strangulation, exudes into the general peritoneal cavity (see Case X.). The patient made an uneventful recovery, primary union being obtained on both sides.

Case IX. Strangulated Oblique Inguinal Hernia. Stricture of Urethra, Complicated by Retention. Chronic Appendicitis.—T. F., aged thirty-eight. Patient admitted to the hospital September 19, 1898. Three years ago, patient, who is a laboring man, first noticed a swelling the size of an orange in the right inguinal region. The swelling has gradually increased to double its former size, and for the past four months it has become partially irreducible. For the past year patient has worn a truss, which has prevented the hernia from coming down, except at times of unusual exertion.

Two days ago patient was seized with abdominal cramps and became so prostrated that he went to bed. There were two attacks of vomiting that night and one on the following day. Catharsis administered by the patient failed to move the bowels, but increased the severity of the cramps. The hernial swelling had suddenly increased in size to that of a child's head, and had become completely irreducible. For the past twelve hours the local condition has remained unchanged. Pulse, 84; temperature, 102° F.; respiration, 22.

On examination, there is a large oval swelling slightly constricted above, extending from a point opposite the internal ring to the bottom of the scrotum. Its longest diameter measures twelve inches, its transverse and auto-posterior diameters about four inches. The testis cannot be felt. The overlying skin is reddened and tender. The swelling is highly elastic and is flat on percussion. There is no impulse on coughing. There is complete retention, the bladder extending half-way up the umbilicus.

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Operation (Ether).—An incision, six inches in length, was made from the upper extremity of the tumor downward, parallel to its long axis, into the upper part of the scrotum, and was deepened until the hernial sac was exposed. The blood-vessels in the wall of the sac were considerably dilated. The cavity of the sac contained several ounces of clear serous fluid. It also contained the cæcum, ascending colon, transverse colon, several feet of small intestine, and a considerable mass of omentum, all in a viable condition. The cæcum was only partially covered by peritoneum. The appendix, retro-cæcal, was about six inches in length and extended vertically upward toward the liver; it was considerably thickened, and firmly adherent to the wall of the colon throughout its entire extent. The cause of the constriction proved to be the margin of the internal abdominal ring, which was divided from without, permitting of the reduction of the contents of the sac. The appendix was then removed, the cæcum returned, the hernial sac separated from the cord and amputated at the level of the internal ring, and the operation concluded by the Bassini method. After the application of the dressing a filiform bougie was introduced through the stricture into the bladder, and was "tied in," serving as a guide for the passage of urine.

The patient made an uneventful recovery, primary union being secured. The stricture was subsequently treated by dilatation.

Bacteriological examination of the fluid within the hernial sac detected no germs. Microscopical examination of the appendix showed a chronic inflammation of all its walls.

In the description of the foregoing cases, the character of the fluid within the hernial sac as indicating the intensity of the constriction has been discussed. Mention has also been made of subsequent bacteriological examination of this same fluid, which has almost invariably been found free from germs in all cases, in which the contents of the hernial sac were in a viable condition. The following case afforded an opportunity of examining the fluid in the peritoneal cavity as well as that in the sac.

Case X. Strangulated Femoral Hernia. Complication. Laparotomy.—E. W., female, aged forty-five; admitted to the hospital February 17, 1897. Previous history negative. Thirty-six hours ago, patient, without known cause, was suddenly seized with a sharp attack of abdominal pain, which, in six hours, became localized

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in the right femoral region, leading to the discovery by the patient of a tender small rounded swelling in the inner aspect of the groin. There was marked vomiting from the start, assuming the fecal type several hours prior to the admission of the patient to the hospital. There was absolute constipation.

Examination revealed the presence of a small rounded swelling over the right saphenous opening the size of a walnut. It was highly elastic, and could not be diminished by pressure. There was no impulse on coughing. Temperature, 99° F.; pulse, 60; respiration, 20.

Operation (Ether).—The hernial sac was exposed by a vertical incision three inches in length. It was found to contain bloody fluid, and tightly encircled by the margin of the neck was a portion of a loop of small intestine about the size of a twenty-five-cent piece. Its color was very nearly black; it had not, however, lost its glistening appearance nor its normal resiliency. There was no odor. The outer edge of Gimbernat's ligament, exposed by deepening the dissection along the inner aspect of the sac, was divided, but did not afford sufficient room for the return of the intestine. The attachment of Poupart's ligament to the spine of the pubis was then divided, the sac being gently retracted externally. While this was being carried out, the strangulated loop suddenly slipped back into the abdominal cavity without affording an opportunity of determining satisfactorily the question of its viability. Inspection of the affected loop was essential, and inasmuch as the small size of the crural ring precluded the possibility of the exposure of the intestine by that route, and any enlargement of it in a vertical direction was undesirable because of the resulting permanent weakness of the abdominal wall, leading to a probable recurrence of the hernia, it was deemed advisable to open the abdominal cavity by the usual intermuscular method (McBurney) which is practised in the treatment of appendicitis. The peritoneal cavity was accordingly opened in this way and found to contain several ounces of sero-sanguinolent fluid. A presenting loop of small intestine was then seized and quickly followed in the direction of increasing congestion until the affected loop was reached. Its suspicious dark color had already become deeply red. It was the site of numerous ecchymoses, an indication of the intensity of the constriction, but was evidently in a viable condition. It was returned into the abdominal cavity and both wounds closed without drainage.

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The convalescence of the patient was uneventful, both wounds healing *per primam*. Examination of both the fluid in the sac and of that in the peritoneal cavity failed to disclose the presence of germs.

Of all the interesting features in connection with strangulated hernia, none is more interesting than the question of determining the viability of the contents of the sac after the division of the constricting band. In some cases the rapid restoration of the normal color, together with the absence of any change in the resiliency of the intestine, establishes quickly and easily the viability of the gut. In other cases the persistence of the black color, the presence of foul odor, the flaccid condition of the wall, the presence of perforation at a point not opposite the constricting band, establish just as quickly the fact that the intestine is dead. There are a certain number of cases, on the border line, however, in which the diagnosis cannot be quickly made, and in which it is proper to wait a sufficient length of time to permit of the restoration of the circulation of the damaged part. At the end of six hours, the suspicious intestine having been left in the wound, surrounded with warm compresses, the question of its viability may be definitely determined, and the operation concluded according to the condition of the gut. This is a much better plan of treatment than to needlessly resect the intestine or to run the risk of returning necrotic intestine into the abdominal cavity. The delay does not add materially to the risk of the operation.

In these doubtful cases, none of the signs ordinarily described to establish the question of viability of the intestine are found to be infallible. The writer has had several cases of strangulated umbilical hernia, in which there was a marked odor to the exudate within the sac, and yet the intestine proved viable. Also other cases, of hernia, in which the color was absolutely black with a diminution of the normal glistening aspect, in which, nevertheless, the intestine was not necrotic. Probably the least infallible of these various aids in determining the question of viability is the condition of the resiliency of the wall of the intestine, a flaccid condition pointing to necrosis of the gut. Yet, that this symptom also is not infallible is particularly well demonstrated by the following case :

Case XI. Strangulated Inguinal Hernia. — P. J. K., aged twenty-two; admitted to the hospital June 21, 1900. Patient has

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had a reducible inguinal hernia on the right side for the past four years, the result of heavy lifting. Two years ago a similar swelling appeared on the left side. Both have been controlled by wearing a double truss, and have never been irreducible.

Eight hours before admission, after heavy lifting, the left hernia slipped down behind the truss and became irreducible. The patient suffered excruciating pain, and the attack was marked by early and persistent vomiting. Chloroform was administered and taxis was employed for three hours by an outside physician without success; patient was then sent to the hospital for operation.

On examination, there is a globular swelling about the size of an orange, occupying the left inguinal canal and extending down a distance of an inch below the external ring. It is tender and cannot be diminished in size by gentle pressure. It is markedly elastic. The percussion-note is flat. There is no impulse on coughing.

Operation (Ether—ten hours after the onset of the strangulation). An incision over the inguinal canal was deepened until the hernial sac was exposed. It contained several ounces of sero-sanguinolent fluid, and tightly constricted by the margin of the internal ring was a segment of intestine about six inches in length. With the division of the constriction the circulation seemed to return to a portion of the affected loop only. In its central portion an area remained in which the wall appeared flaccid, thin, and of diminished consistence. The temporary application of hot cloths did not improve the appearance of the gut. No disagreeable odor could be detected, and a slight peristaltic wave could be elicited by the application of the galvanic current. Pulsation of the branch of the mesenteric artery supplying the suspicious loop could be distinctly felt. It was, therefore, deemed advisable to anchor the affected portion of the intestine by means of catgut sutures to the margin of the aponeurosis and to surround it with warm sterilized compresses. At the end of six hours the flaccid appearance had disappeared and the normal resiliency was restored. The purple color had become red and there was no doubt but that the affected loop was viable. It was accordingly returned into the abdominal cavity, and the wound closed in the usual way. In the interval between the two steps of the operation, the patient regained consciousness and complained of considerable local pain, possibly as a result of the traction on the mesentery necessitated by the temporary sutures be-

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tween that structure and the aponeurosis. There was also some vomiting. The pulse was 97, the temperature 100° F. After the second operation (reduction of the intestine and closure of the wound), the pulse rose to between 120 and 130, but quickly subsided, reaching 80 on the third day. For twenty-four hours there was considerable restlessness and some pain in the region of the umbilicus, much less severe, however, than that experienced after first operation in the vicinity of the wound. The bowels moved on the second day, after the administration of a mild laxative.

Subsequently, the post-operative course was uneventful. There was some slight superficial suppuration in the wound, which, however, did not extend to the deep sutures in or beneath the aponeurosis, and healing was complete in three weeks, the patient leaving the hospital with a strong abdominal wall.

In conclusion, mention might be made of the manner of dividing the constriction in cases of strangulated hernia. In all of the foregoing cases the constriction was invariably divided from without, leaving the neck of the hernial sac undamaged. This method enjoys the advantage that all blood-vessels crossing the constricting band may be divided between two ligatures, thereby diminishing the risk of hemorrhage. In the older method, the herniotomy knife was introduced between the affected loop of the intestine and the neck of the sac, the constriction being divided from within in a direction least likely to divide any important blood-vessel. Such a procedure is inevitably accompanied by the risk of the division of some unexpected or unusual vessel and the resulting hemorrhage may form a very disagreeable complication. In the cases reported in this paper, the constriction in the inguinal varieties was relieved by the division of the margin of either the internal or the external abdominal rings. The division of the former was greatly facilitated by the exposure of the inguinal canal, an early step in the "Bassini" operation. In the femoral variety, the constriction was usually relieved by the division of the outer edge of Gimbernat's ligament. If that failed to provide sufficient room, the attachment of Poupart's ligament to the spine of the pubis may be severed. If in this way the constriction is divided from without, the divided edges of ligament or fascia may subsequently be approximated by suture, which in the older method of division from within would be impossible.

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IV.

ACUTE PANCREATITIS, WITH THE REPORT OF THREE CASES.

By George Woolsey, M.D.

Acute inflammation of the pancreas as a condition amenable to surgical operation is not of frequent occurrence, and is rather obscure. Considerable light has been recently thrown upon this subject by the publication of pathological and experimental researches, and the report of cases operated upon. The three cases here reported all belong to a distinct group of inflammations of the pancreas, with acute onset and general invasion of the peritoneum, and without gangrene or abscess of the pancreas. A similar case operated upon by Dr. Eliot was in my service during his convalescence.

The classification of pancreatic inflammations has formerly, for some unknown reason, been unlike that of inflammation elsewhere. Robson[1] wisely adopts the classification of acute, subacute, and chronic, which is applied to inflammations elsewhere. Acute pancreatitis may be divided into several varieties according to the presence or absence of certain striking features and sequelæ, *i.e.*, hemorrhage, necrosis, fat necrosis, abscess, or general peritonitis.

Acute pancreatitis is one of the causes of sudden death, as first brought into notice by Zenker in 1874, and in most cases of acute pancreatitis the patient is in a more or less profound collapse at the onset of the inflammation. This collapse Brentano[2] attributes to the infection of the peritoneum, which, in his opinion, most often takes place through the perforation of a suppurating focus in the gland. But as the collapse comes on at the very onset, this explanation seems hardly probable. The nearness to the solar plexus is assigned by others to account for the collapse. In acute cases, such as those leading to sudden death, the presence of hemorrhage is a frequent feature. The gland is more or less infiltrated with

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small hemorrhages, and more extensive ones may be found in the root of the mesentery, the retro-peritoneal tissue, or the lesser peritoneal sac. It is still a disputed point whether this hemorrhage is primary or is secondary to and the result of the inflammation. The latter view has been strongly upheld by Fitz, and is now the one most generally accepted. In Case I. there was apparently a hemorrhagic condition, the fluid in the peritoneal cavity was deeply colored by it, and the report of the microscopic examination of this fluid stated that it "looks like decomposed blood." Robson[1] was the first to suggest an explanation of this hemorrhage in cases of acute pancreatitis. He suggested that it was due to the action of the glycerin liberated in the fat necrosis. It has also been suggested[3] that it might rather be due to the action of the peptones and albumoses produced by the action of the pancreatic juice escaped into the tissues. Besides the hemorrhages, a hemorrhagic tendency, similar to that sometimes observed in cholæmia, is sometimes present in pancreatitis. This, Robson[1] thinks, may perhaps be explained by a diminution of blood-plates, which was found on examination. This hemorrhagic tendency is more often, if not exclusively, observed in cases of chronic pancreatitis where the indurated head of the pancreas obstructs the common bile-duct by pressure. Robson has found doses of calcium chloride (gr. 30–60 t.i.d.) useful in the prophylaxis or treatment of this hemorrhagic tendency, especially when due to pancreatitis.

Another feature of some cases of acute pancreatitis, also illustrated by Case I., is the occurrence of fat necrosis in the subperitoneal fat, as in the omentum, etc. This condition is sometimes found in other ailments, but is rarely met with apart from affections of the pancreas. It is not found in all acute pancreatic diseases, and is most constant in hemorrhagic and necrotic pancreatitis, less often in pancreatic abscess, etc. This is borne out by the three cases reported, for it was found in only one, and that a case of hemorrhagic pancreatitis. It is essentially due to the interference with the discharge of the pancreatic secretion, and to its escape into the tissues, whence it may enter the lymph and blood-vessels. Flexner[4] has studied fat necrosis pathologically and experimentally, and reaches the conclusion that the escape of the pancreatic secretions into the tissues about and near the pancreas is the cause, and that this escape is chiefly due to lesions of the pancreas, including those

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interfering with the discharge of its secretions, and also to disturbances of its circulation. He thinks that it is highly probable that fat necrosis is due to the presence of the fat-splitting ferment steapsin which he could demonstrate to be present. Flexner[4] states that the pancreatic secretion may enter the peritoneal cavity without setting up a diffuse inflammation. In Case I., where fat necrosis was present, and in Case II., where pancreatic secretion was found in the fluid in the peritoneal cavity, no pathogenic organisms were found. Williams[5] states that peritonitis is not usually present with multiple fat necrosis. Ceccherelli,[6] in a paper read before the Paris Congress in 1900, says that the extravasation of normal pancreatic secretion into the peritoneal cavity never causes peritonitis. Bottini[7] states that the pancreatic secretion, coming in contact with the peritoneum, may be indirectly the cause of peritonitis, but the essential cause of the latter is bacterial infection. Bacteria may reach the pancreas through its ducts, and in other ways, and are the immediate and essential cause of the various forms of acute pancreatitis.

Another variety of acute pancreatitis is characterized by the occurrence of necrosis of the tissue of the pancreas in whole or in part. As to its cause Opie[8] regards it as a late stage of the hemorrhagic lesion. Experimentally it is shown that lesions of or near the pancreas are apt to involve necrosis of that organ. This condition has been operated upon a number of times, but the prognosis is grave. R. Morian,[9] in 1889, stated that of eleven cases of hemorrhagic necrosis of the pancreas, with abscess, operated on, only one recovered, and that one had severe diabetes later on. That these figures do not represent the results of the more recent surgery of the pancreas is evident from an examination of the literature and from personal reports. Brentano[10] reports a case of recovery after operation and two cases of Hahn's. Boeckel,[11] in a paper read before the Paris Congress of 1900, reports twenty operations on pancreatitis purulenta et gangrenosa with eleven recoveries.

Suppurative or purulent pancreatitis is another variety or advanced stage of acute pancreatitis. A localized abscess may occur in or about the pancreas, as a result of necrosis of the pancreas or without the occurrence of such necrosis. Abscess may also result from a subacute pancreatitis. It is in this variety or stage that most operations for acute and subacute pancreatitis are performed. In the three cases forming the basis of this report, and the similar case

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of Dr. Eliot's, there was no localized abscess, but the infection of the peritoneum was more general. Hence we may be justified in grouping these cases as another variety of acute pancreatitis. The reports of operations on such cases in the literature of the subject seem less common, hence the interest attaching to these cases is so much the greater.

In this connection we may remark that Flexner adopts Oser's classification into: (1) Acute hemorrhagic, (2) suppurative, (3) necrotizing, and (4) chronic indurative pancreatitis. But, as we have seen, the first three forms are merely varieties of acute pancreatitis.

As to the etiology, the cases here reported have little to suggest except that alcoholism, pronounced in Cases II. and III., is an important factor, probably by causing a gastro-duodenal catarrh. The latter condition is indicated in the several attacks of colicky epigastric pain associated with vomiting. As Robson[1] says, the essential and immediate cause of the various forms of pancreatitis is bacterial infection, and the usual channel of infection is the duct. Hence the inflammation of the gastro-duodenal tract predisposes to this infection. For a similar reason stones of the pancreatic duct or the lower end of the common bile-duct may act as extrinsic causes, as pointed out by Robson and others. The last-named writer was told by a pathologist that in cases of obstruction of the lower end of the common bile-duct pus can usually be expressed from the duct of Wirsung. It is in the etiology of the chronic forms of pancreatitis that impacted gall-stones, or operations performed for their removal, are particularly important. None of the cases here reported gave a history of previous injury, which is one of the causes of pancreatitis. It may result from trifling blows, and it has been suggested that the sickening sensation due to blows on the epigastrium is due to the bruising of the pancreas rather than of the solar plexus. Acute pancreatitis is most common in males, and sometimes attacks those in the most robust health.

As to the symptoms, all my cases were much alike. There was a sudden onset with more or less collapse—as indicated by the pallor, feeble and rapid pulse, and general prostration—severe cramp-like epigastric pain, not relieved by the vomiting, distention of the abdomen, and an irregular temperature. In the class of cases reported there is soon abdominal rigidity and tenderness, but no mass can be palpated. In only one of the cases (Case I.) was there

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obstinate constipation simulating intestinal obstruction. This is not infrequently observed, and may lead to an error in diagnosis. It is attributed by Brentano[10] to effusion into the lesser peritoneal sac, causing an irritation of the peritoneum. The distention of the colon, etc., is thought by Dörfler[12] to be due to pressure on the solar plexus.

Glucose in the urine was only present in Case III., and was here an important factor in leading to a diagnosis. In Robson's[1] experience it occurs rarely, in fact only in extensive cirrhosis or malignant disease of the pancreas. Brentano[10] says that it appears when the pancreas in whole or in part has been destroyed. It has also been observed after operations for necrosis of the pancreas. Opie[8] observed a relationship between lesions of the islands of Langerhaus and the occurrence of diabetes.

Fat in the stools was observed in none of the cases reported, though Robson regards it as more common than glycosuria, but not at all universal. Although Walker, of Peterborough,[1] showed that the absence of pancreatic secretion from the intestines, even if bile is present, led to pale-colored stools, the latter were dark in all the cases reported, though, from the condition of the pancreas as felt, it is more than probable that none of its secretion entered the intestines.

The diagnosis is almost always difficult and uncertain, owing to the variety of inconstant and contradictory symptoms. The sudden onset, collapse, severe and cramp-like epigastric pains not relieved by the vomiting, the abdominal distention, in connection with some etiological factor (injury, alcoholism, biliary calculi, etc.) and the exclusion of other lesions enable one sometimes to make a very probable diagnosis. When, in addition, there is glycosuria or an excess of free fat in the stools, the diagnosis is still more probable. Most cases are not diagnosed before operation. This happened in Case I. In Case II. a probable diagnosis was made by reason of the recent occurrence, within a week, of Case I. Case III. was diagnosed by the group of typical symptoms combined with the alcoholic history and the glycosuria. As to the confirmation or establishment of the diagnosis by the operation—in all three cases the pancreas was felt to be hard and enlarged throughout; in Case I. there was fat necrosis and bloody fluid; in Case II. the fluid gave a pancreatic test; and in Case III. there was

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peritonitis without other cause. Edsal[13] has studied the diminution of the ethereal sulphates in the urine to which some attach importance as an aid to diagnosis. He concludes that this sign is not constant, nor of much value, and only of importance when positive.

As to operative treatment, it is generally admitted that operation should be avoided in the acute early stages when the symptoms are indefinite and the patient is in collapse. As the diagnosis is uncertain, the operation is often undertaken for some of the conditions which it simulates and from which it may be difficult to differentiate it—intestinal obstruction, septic peritonitis from an unknown cause, biliary colic, etc. In the class of acute cases represented by those here reported, the treatment resolves itself, as Robson[1] well says, into that of peritonitis commencing in the superior abdominal region. I have employed anterior abdominal incisions only; Robson[1] recommends, in addition, or as a substitute if the diagnosis is made, a posterior incision in the left costo-vertebral angle. The latter is especially useful in cases of necrosis or of localized pancreatic abscesses. Of course, in cases like those reported irrigation and drainage of the peritoneal cavity are necessary. Vigorous stimulation is required, with or without saline infusion during and after the operation.

The prognosis is grave in acute pancreatitis. If the patient survives the collapse there is the danger of necrosis, abscess, or general peritonitis. The prognosis varies with the severity and form of the acute inflammation. Statistics are not yet sufficient to warrant an exact statement. The hemorrhagic form appears to offer the worst prognosis, 5 recoveries in 23 operations (Boeckel[11]), the necrotic form the next worse if it is not equally bad. When a localized abscess forms, the prognosis is probably better. What the prognosis is, in the variety of acute pancreatitis to which my three cases belong, I am unable to say. Certainly the 100 per cent. of recoveries of these three cases would not apply to a large number of similar cases. All these were very sick patients, and in all the result was very uncertain for some days after operation. The prognosis in all was considered very doubtful. Undoubtedly the prognosis of acute pancreatitis without operation is very much worse. Recovery without operation is almost out of the question, though Morian[9] states that two cases of recovery are known after spontaneous evacuation through the bowels.

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The pancreas itself is now added to the list of those parts attacked directly by operation. Ceccherelli[6] says that experimentally the removal of the entire pancreas is possible and is compatible with life, and F. Franke[14] reported at the last Congress (1901) of German Surgeons three cases of carcinoma of the pancreas operated on by himself, in one of which total extirpation was said to have been performed with recovery. The patient died five and one-half months later of recurrence in the lymph nodes without the occurrence of diabetes. Of the three cases whose histories are appended, Case II. was seen a year later in good health, and Case III. was recently under observation and in excellent condition.

Case I. Acute Pancreatitis. Fat Necrosis of Omentum.—T. H., female, aged twenty-four; single; admitted September 21, 1900.

Previous History.—Typhoid fever seven years ago. Two years ago several attacks of cramp-like pain in the epigastrium with vomiting, lasting several hours.

Present Illness began three days ago with cramp-like pain in the epigastrium. After twenty-four hours, pain most severe in right iliac region. Vomiting began on second day and has persisted. Bowels constipated for past three days in spite of cathartics.

Examination.—Patient is poorly nourished, anæmic, and looks sick and septic. Tongue heavily coated. Abdomen somewhat distended. General rigidity and tenderness of the abdomen, more marked in the lower half of right side. Pain in the abdomen is severe and general, most marked, however, in region of appendix. No mass palpable. Vaginal examination: Cervix points somewhat transversely, tenderness in right lateral fornix, no mass palpable.

Operation, September 21.—Intermuscular incision over appendix. Several ounces of a dark brownish fluid came away, and still more of the same fluid was removed from the pelvis. The appendix and pelvic organs found to be normal. Gall-bladder felt to be slightly enlarged and adherent. Oblique three-inch incision parallel with and below right costal margin exposed gall-bladder, which was a little distended and adherent to omentum at one or two points. Several ounces of a dark brown fluid escaped on opening the peritoneum. At the junction of the small omentum with the lesser curvature of the stomach was a greenish-yellow patch of the size of a quarter of a dollar, looking necrotic, and a similar area in the

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great omentum just below the stomach, surrounded by several smaller patches. In the omentum presenting in the lower wound were two or three areas studded with small yellowish-white spots resembling fat necrosis. Specimens from these and the upper areas were taken for examination. The pancreas was palpated and felt to be much enlarged and hard. Drainage of sterile gauze surrounded by rubber tissue introduced through lower wound to iliac fossa and pelvis and through upper wound to gall-bladder and necrosed area near stomach. The remainder of the wounds were sutured in layers. Probable diagnosis of acute pancreatitis with fat necrosis. Patient collapsed during operation, but responded to saline infusion of 1500 c.c.

The temperature rose to 101.5° F. on the two following days, and to 102° on the third day, but after that came down. The pulse, during the same time, varied from 92 to 120, and then dropped with the temperature. For the first two days the patient was restless, complained of severe abdominal pain, and vomited once each day. The bowels did not move until the third day after the operation, after which the patient was more comfortable. The drainage-wicks were gradually shortened and there remained two small sinuses when the patient was discharged, October 10, to return for dressings to the accident ward.

Pathological Examinations.—Leucocytes: September 21, 39,000; September 22, 15,500; September 28, 16,800; October 2, 14,200. Examinations of urine showed a trace of albumin, no casts, a few leucocytes, a maximum specific gravity, 1034, September 22, and no sugar. Specimen excised from omentum; microscopic examination; a number of little spots of fat necrosis surrounded by a little inflammatory infiltration (Dr. Thacher). Fluid from abdominal cavity; microscopic examination; specimen looks like decomposed blood (Dr. Thacher).

Case II. Acute Pancreatitis.—F. J. C., male, aged thirty-two; married; driver; admitted September 26, 1900.

Previous History. — Moderately heavy beer-drinker. Denies venereal history. Never had jaundice. Always well, save for attacks called colic. One year ago severe epigastric pain and frequent vomiting, bowels regular. In bed two weeks. Four months ago similar attack. The pain would occasionally shoot up to the right and left shoulder and from the epigastric region around the right

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costal margin. Similar attack on the evening of September 21, but not so severe. He worked the following day, but has not felt well since.

Present illness began with a chill last night, and with increase of epigastric pain. Bowels moved after cathartic. At 10.30 this A.M. was seized with violent cramps in abdomen, and vomited three times.

Examination.—Patient is somewhat anæmic and looks sick and septic. Tongue coated. Slight abdominal distention. Abdomen is rigid, especially under the costal margin. Tenderness marked in epigastrium and both hypochondriac regions, slightly more on right side. No mass palpable. Some tenderness in lower right side of abdomen and around umbilicus. Patient suffering severe pain. Diagnosis of possible pancreatitis, the first case being in mind.

Operation, September 26.—Three-inch median incision above umbilicus. Slightly turbid serum escaped from general peritoneal cavity. Gall-bladder and stomach normal. Intestines slightly congested. The pancreas could be palpated through the stomach, traced from left to right and felt to be hard and enlarged. The head especially presented a hard mass, suggesting inflammatory deposit or new growth. Drainage down to the foramen of Winslow, sterile gauze surrounded by rubber tissue. Pulse rapid and feeble at end of operation.

The temperature ran high, 101.5° to 104° F., and the pulse rapid, 86 to 140 for the first four days only. Saline infusions given September 27. No vomiting after recovery from ether. Patient very restless, noisy, and delirious much of time for first week, and then much better. He was alcoholic, and large quantities of whiskey seemed to affect his restlessness and delirium better than drugs. The bowels moved the second day and regularly thereafter. The urine contained epithelial, granular, and hyaline casts, and a considerable trace of albumin, but no sugar. The drainage was removed after forty-eight hours and considerable reddish-brown fluid escaped from the wound. The stitches were removed on the fifth day.

The leucocytosis was 17,600 September 26, before operation; 21,400 September 27, and 9,000 October 1. Pathological examination of fluid from peritoneal cavity showed microscopically very large cocci, evidently non-pathogenic. It changed boiled starch

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into glucose in half an hour, indicating the probable presence of some element of the pancreatic juice (Dr. Tuttle).

Discharged cured, October 15, 1900.

Case III. Acute Pancreatitis. General Peritonitis. Pelvic Abscess.—J. P., male, aged twenty-nine; married; truckman; admitted July 27, 1901.

Previous History.—Is a steady and hard drinker of beer and whiskey. Smokes to excess. No history of syphilis. Always well, except for attacks of "indigestion" after drinking hard, when he has pain, chiefly in the epigastrium. He was a painter six years ago, but never had painter's colic.

Present Illness.—He had been drinking hard and eating almost nothing for the past week or more and had vomited occasionally. On July 16 (the day of admission to the Medical Division) after drinking beer he vomited immediately and had sharp pain in epigastrium which was not relieved by vomiting and did not radiate. The whole abdomen was markedly tender, rigid, and distended. The vomiting continued for the first few days in hospital, and the vomitus was greenish in color. The bowels were regular, the stools dark brown, and no free fat or fatty crystals were detected. The urine was of high specific gravity (1050) and contained sugar; the first day gr. xxviii. to oz. i., the second day a trace, and none subsequently. Many hyaline casts were present. The temperature was irregular (99 to 102⅖° F.) with a tendency to an evening rise. Pulse, 88 to 110, small and soft.

I first saw the patient July 17, at the request of Dr. Thacher, and again on the 18th and 19th. The diagnosis of probable acute pancreatitis was made from the alcoholic history, the sudden onset, the intense epigastric pain and tenderness not relieved by vomiting, the abdominal distention, the sugar in the urine, and by exclusion. As the symptoms gradually but steadily diminished, operation, though advised, was delayed. On July 26 the leucocytosis was 26,000; abdominal distention had reappeared; and tenderness and rigidity, which had increased in the last two or three days, were more marked in the lower right side of the abdomen. Septic peritonitis was evidently present, and he was transferred to the surgical side July 27.

Operation, July 27.—Median incision below umbilicus. On opening peritoneum a large quantity of foul-smelling purulent serum mixed with gas escaped. This pus was found throughout the perito-

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neal cavity, which was thoroughly washed out. A median incision was made above the umbilicus, and the pancreas was felt to be much enlarged, firm, and hard. A few adhesions were found between the stomach and liver, and were broken up. Otherwise the viscera were normal, except for congestion of the intestines most marked in lower half of abdomen. The appendix was not found on the right side, and the pelvis was closed by adhesions of the intestines. These adhesions were broken up, and revealed an abscess in the pelvis containing pus similar to, but thicker than, the pus in the peritoneal cavity. In the walls of the pelvic abscess was the appendix, which was swollen, but apparently not otherwise diseased. This pelvic abscess was thoroughly cleaned out. Owing to the poor condition of the patient I refrained from dividing the gastro-colic omentum and inspecting the pancreas, as I desired to do. Gauze drainage was carried through the lower wound from the pelvis and right iliac fossa, and through the upper wound from near the foramen of Winslow. The angles of the wounds were sutured.

The temperature reached 101° F. the second day after the operation and 104° the third and fourth days, and then gradually fell to about normal. The pulse varied from 86 to 130. He vomited considerable quantities of brownish fluid for the first four days after the operation and occasionally thereafter. There was considerable abdominal pain for the first four or five days. The bowels moved freely on the third day, and thereafter he had a profuse diarrhœa for ten days or two weeks. His appetite was poor and he emaciated rapidly. He was dressed on the third day, and daily thereafter for some time. The discharge was profuse, the drainage gradually shortened, and at the time of his discharge from hospital, September 6, the upper wound had been healed for three weeks, and a small granulating area remained in the lower wound. His weight was much increased and his general condition much improved.

Pathological examination of fluid from abdominal cavity by Dr. Tuttle showed streptococci, but the growth was not characteristic of the most virulent variety.

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V.

A RARE TUMOR OF THE JEJUNUM—EXCISION—RECOVERY.

By Andrew J. McCosh, M.D., and John S. Thacher, M.D.

Mrs. A., aged forty-three; family history and personal habits good. No pregnancies. At the age of eighteen the patient was confined to bed for several weeks on account of some intestinal trouble which caused general abdominal pain, cramp-like in character, accompanied by more or less abdominal distention and marked jaundice.

Her present illness began three years ago. During these years she has been subject to attacks of severe abdominal pain which she described as cramp-like, often very sharp and cutting, and while the pain was general it was more severe on the left side of the abdomen. At first there was an interval of several weeks between the attacks, but their frequency has gradually increased. Between the attacks she was well, though troubled with belching of gas and rumbling of wind in the bowels. Ordinarily her bowels were fairly regular. The pain was more apt to occur when her bowels were constipated. During the attacks she often vomited. The attacks were more apt to occur soon after eating a hearty meal. On one occasion for a period of three weeks there was a slight jaundice.

For six months prior to her entrance into the hospital the frequency of the attacks had much increased, and recently they were of almost daily occurrence. There were no chills. She had never noticed blood in her stools. She had lost twenty pounds in weight in the last year. From June 10 to 18, 1901, she was practically confined to bed on account of the pain. She then came to the hospital, and from June 18 to 26 she remained under the care of Dr. Northrup in the medical division. During this week from one to three severe attacks occurred daily, their duration being from a few minutes to one or two hours. The pain was severe, and during the attack there

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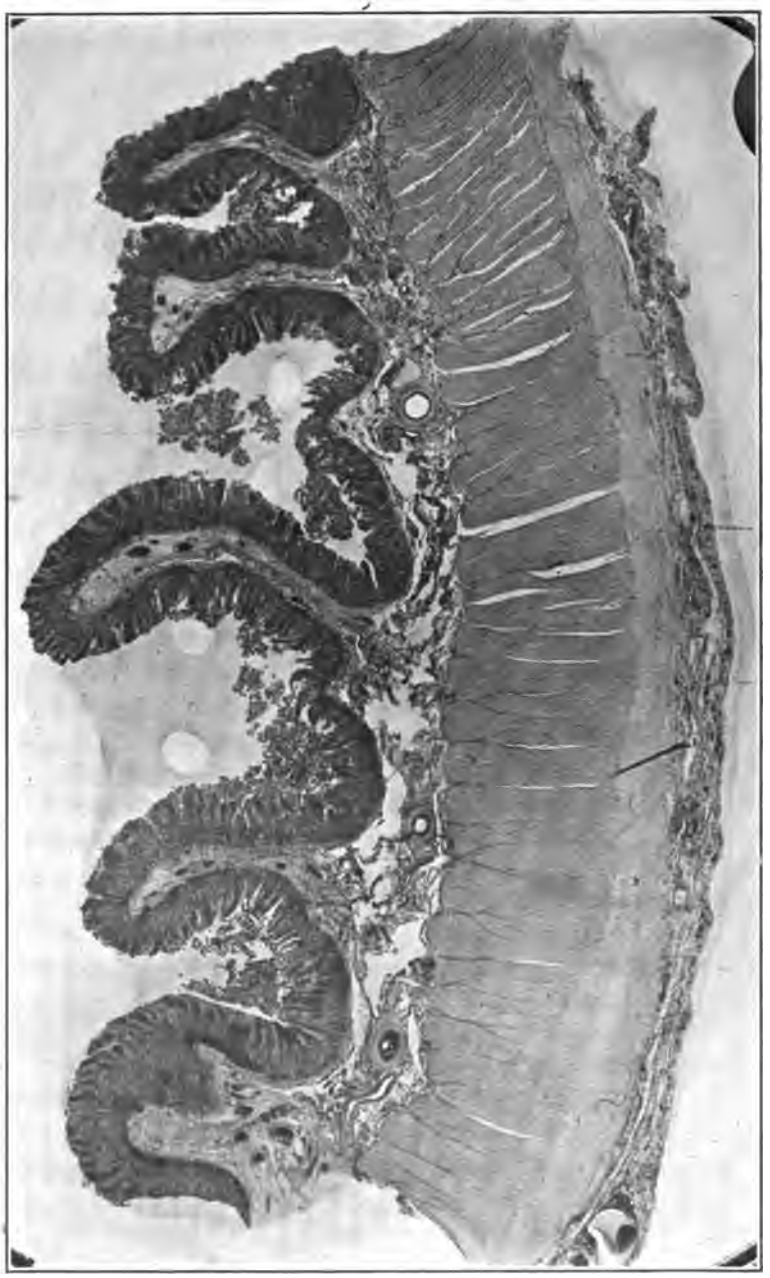

FIG. 1.—From the upper end of the specimen, showing the hypertrophy.

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FIG. 2.—From near the centre of the specimen, showing cell-groups in subserosa and thickened mesentery.

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was generally increased abdominal distention. The stools were semi-solid and fluid. Cathartics were needed. Diet had no effect on the pain. On physical examination the abdomen was found to be persistently more or less distended by gas in the intestines, and often its rumbling could be distinctly heard. Below and to the left of the umbilicus an indistinct mass could be felt, and by combined abdominal and vaginal palpation it could be more distinctly mapped out. Its exact origin could not be determined, neither could its nature. It was evident, however, that it was the cause of partial obstruction of the bowels. A malignant growth was suspected, but under any circumstances the case was evidently one for a laparotomy.

The blood on examination showed: Red blood-cells, 4,750,000; hæmoglobin, seventy-five per cent.; leucocytes, from 4,500 to 5,000.

The urine was normal, and the Indican test was negative.

On June 28, under chloroform anæsthesia, a median incision was made. The small intestines were found in part collapsed and in part distended. Just distal to a much distended coil was found a fusiform tumor involving all the coats of the small intestine. The mass involved four or five inches of the gut, and at its thickest point was about two and a half inches in diameter. It appeared nearly solid, the intestinal wall varying in thickness from a half to one inch. The tumor felt more or less nodular, and was hard throughout. In the mesentery opposite the tumor were several enlarged lymphatic glands, one being as large as a pigeon's egg. These glands extended down to the very base of the mesentery. Fifteen inches of the intestine, with the tumor in its middle, was excised with a corresponding V-shaped portion of mesentery extending down to its attachment to the vertebral column in order that all enlarged glands might be removed. The intestine on each side of the portion exsected had been tied with tapes. A number of large vessels in the mesentery required ligation. Its cut edges were sutured by a continuous catgut suture; and the cut intestinal ends, being approximated by an assistant, were united by: (a) A partly continuous catgut suture through the mucous coats; (b) an interrupted Lembert suture of fine silk through the serous and submucous coats.

During the entire operation the patient's condition was very poor, but she soon rallied after return to bed.

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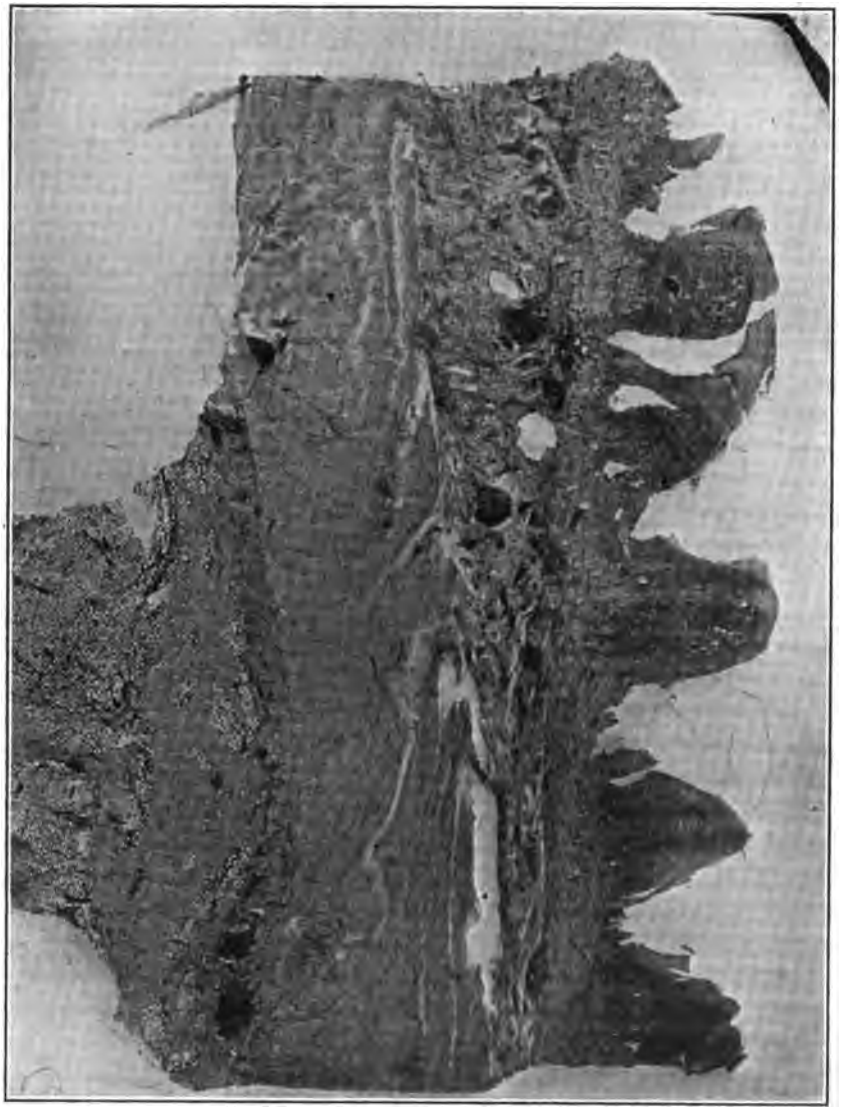

FIG. 3.—From near the centre of the specimen, showing altered mucosa and cell-groups chiefly in the submucosa.

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During her convalescence no unfavorable symptoms developed with the exception of attacks of colic due to indiscretions in diet. Since the operation the patient has gained thirty pounds in weight. She can now eat everything, and digestion is undisturbed. At the present time, nine months after the operation, she enjoys the best of health. At the time of operation the tumor was regarded as a malignant one. The calibre of the intestine was almost occluded, the stricture at one point being so tight that a full-sized surgical probe passed through it with difficulty.

The specimen is a section of intestine nine inches in length. From the appearance of its mucous folds it is evidently a part of the jejunum. At the centre of the specimen there is great thickening and induration of the wall and constriction of the lumen, giving the appearance of a cancerous lesion. One end, which we shall call the lower end, is of normal appearance, the folds of the mucous layer presenting nothing abnormal, and the various coats being of normal or but slightly increased thickness. The muscular layer here is 1 mm. thick. At the other end, which we shall call the upper end, both the mucous and muscular layers are distinctly hypertrophied. The mucous folds, while regular, are much coarser, and the muscular coat measures 3 mm. in thickness.

At the centre the mucous folds are partly destroyed, producing a surface partly smooth, partly ragged, and slightly excavated. Just above this the valvulæ conniventes are rather irregular and run longitudinally for nearly two inches. At the centre the wall is much thickened, reaching three-quarters of an inch, all coats taking part in the thickening. Here, too, the mesentery is greatly thickened, measuring one and one-quarter inches transversely at its attachment to the intestine. At this thickest part there is marked constriction, the lumen being only three-quarters of an inch in circumference, while four inches above it is three and one-half inches in circumference, and four inches below it is two and one-quarter inches in circumference.

Microscopical Examination.—The most noticeable change seen with the microscope is the accumulation of small cells. The mucous membrane of sections taken from the central part of the specimen consists of these cells in almost solid mass, with an abundance of dilated capillary blood-vessels. This cellular layer, representing the mucous membrane, is about 2 mm. thick through the ridges or folds.

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FIG. 4.—Some of the cell-groups more highly magnified.

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In the other coats these cells are partly diffuse, but chiefly in crowded groups, the largest of which are 1½ mm. in diameter. These groups are most numerous in the submucous coat, but are found also in the muscular and subserous coats. The majority of these cells resemble lymphocytes, though the prevailing size is larger than that of ordinary lymphocytes, the cell body being very small or inappreciable, the nucleus round, well filled with granules of various sizes which stain deeply with hematoxylin. A somewhat smaller number of cells have cell bodies of diameters two to four times that of the nuclei, polygonal, some of them elongated, the nuclei being often peripheral or at least eccentric. Many of the nuclei of each of these kinds of cells are larger and paler, having fewer blue-stained granules. The second group of cells described, at least some of them, resemble morphologically plasma cells, others resemble the smaller polygonal cells seen commonly in granulation tissue. They do not resemble the epithelioid cells of tuberculous tissue. Occasionally there are also found singly, rarely in small groups, polymorphonuclear leucocytes. A few eosinophil cells are found. In these various groups the cells are so evenly arranged and the circumscribed groups are so numerous and large, and the diffuse infiltration is so abundant that a picture is produced very like that of a round-cell sarcoma. In some spots the cells are finely and intimately mixed with the elements of the muscular and connective tissue. In other spots cellular strands run through the tissues. Again there are round nodules of cells evenly spread and without appreciable stroma. And still again, in the remains of the mucosa there is the even massing of these cells unbroken by other structures excepting abundant capillaries distended with blood. Where the epithelial and glandular elements of the mucosa are retained in the more diseased parts of the specimen, there is some irregular hypertrophy of the mucosa, and there are some of the cell-groups beneath the epithelium and between the glands, and many such groups and much infiltration in the deeper coats. Where the glands and superficial epithelium have been destroyed there is a layer on the surface consisting of polymorphonuclear leucocytes, some other small round cells, and granular débris.

No giant cells are found, no cheesy or necrotic areas, no distinct spots of fibrous inflammatory remains.

A number of sections have been stained and searched for tubercle

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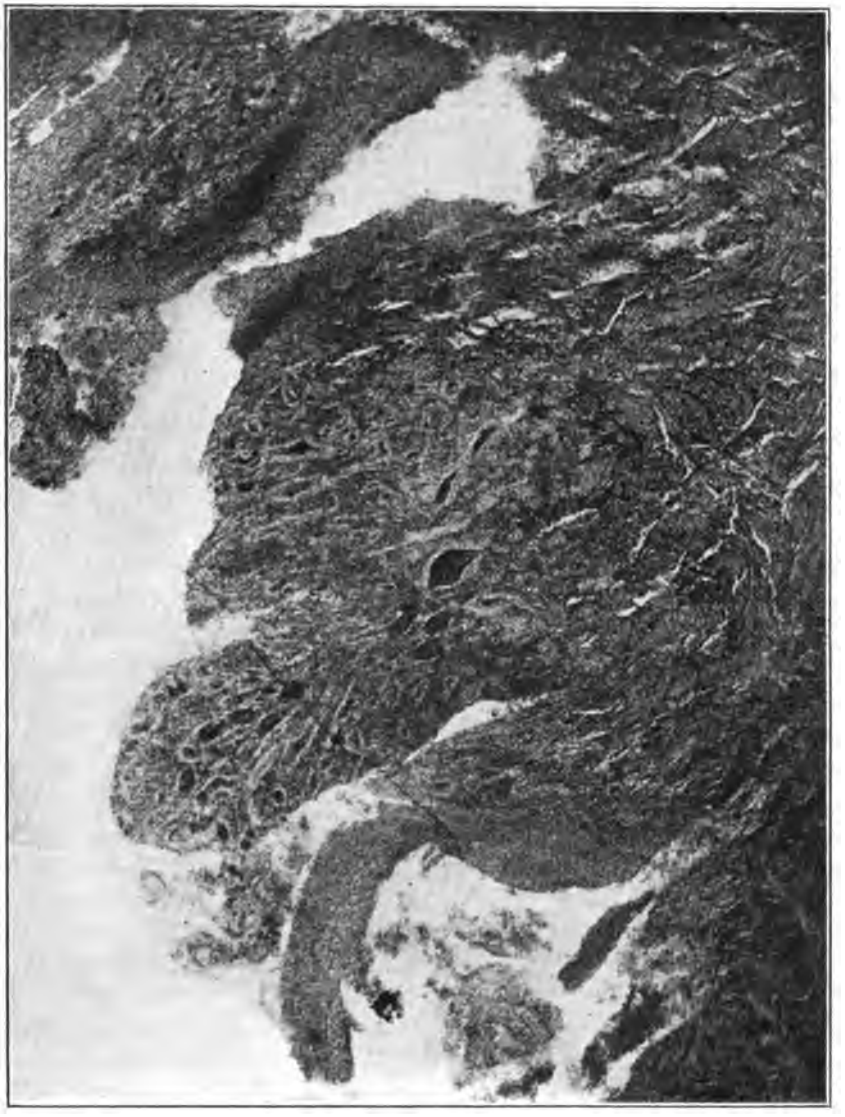

FIG. 5.—From the altered mucous membrane.

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bacilli, with a negative result. In the mucous membrane bacilli are seen which morphologically resemble colon bacilli.

We come now to the main question—of the nature of these changes. Much surprise was felt at the entire absence of cancerous lesions, the gross appearances having been such as to at once suggest carcinoma. But the microscopical appearances narrow the question down to one of sarcoma or inflammation. As stated above, the abundance and diffuseness and uniformity of the cellular invasion strongly suggest sarcoma. And yet there is still something lacking in these respects, and the character of the small cells is rather that of inflammatory infiltration. There is certainly nothing found disproving this latter explanation.

During the past few years many cases have been reported of hypertrophic or hyperplastic intestinal tuberculosis. Lartigau, in the *Journal of Experimental Medicine* (Vol. VI., No. 1, November 29, 1901), gives an excellent review of this subject. Many of those cases have clinically, as well as on gross examination of the lesion, at first seemed to be cancerous. Some of them have showed, under microscopical examination of sections of the intestine, very few, and some no histological features which could be said to be characteristically tuberculous, the nature of the lesions being determined by the discovery of tubercle bacilli, or by distinctly tuberculous lesions in other parts or by a general resemblance to other cases known to be tuberculous. In a few the microscopical appearances have closely simulated those of sarcoma. Hartmann and Pilliet, in describing a case ("Bull. Soc. Anat., Paris," Vol. V., p. 471, 1891), record "an enormous embryonal infiltration which has completely transformed the tissue so that it looks like a true sarcoma." Our case does not follow the rule that hyperplastic intestinal tuberculosis very rarely affects the small intestine alone, and when it does is found in the lower ileum. In its gross appearances, however, our specimen resembles many of those reported as tubercular, and in its histological features is very like some of them. In spite, therefore, of its location high up in the small intestine, of the absence of the more characteristic tuberculous features, and of the failure to demonstrate tubercle bacilli, this case resembles in the main that group of cases called hyperplastic intestinal tuberculosis, and there seems to be a high degree of probability that such is the nature of this case.

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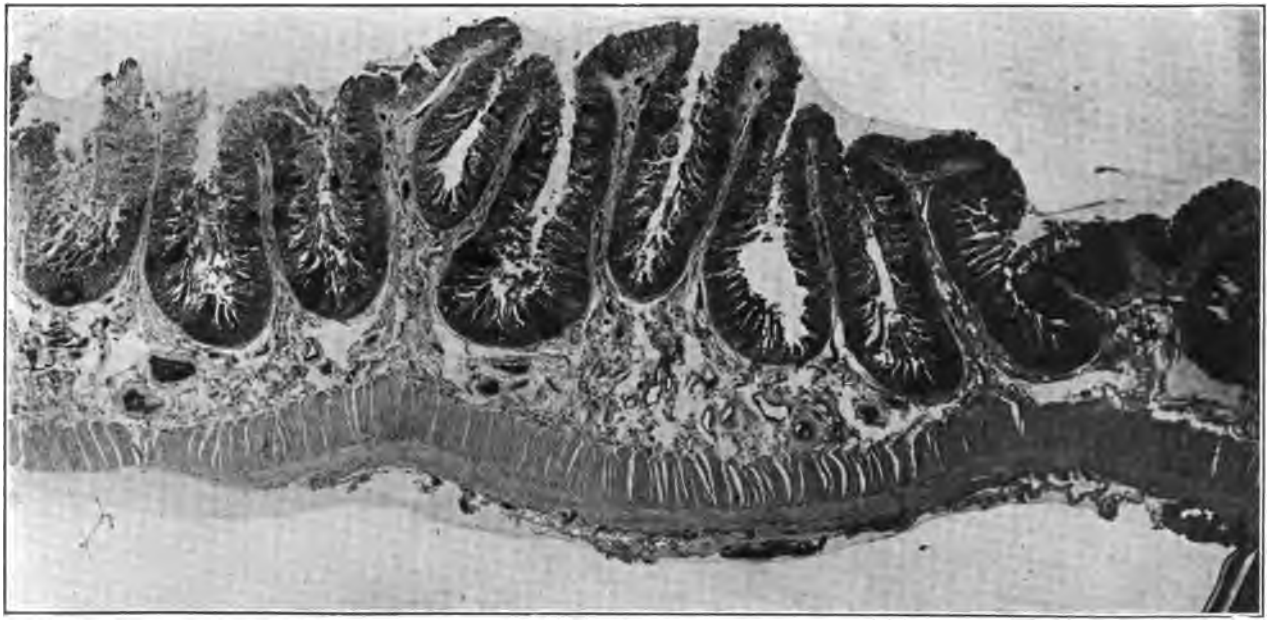

FIG. 6.—From the lower end of the specimen.

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VI.

TWO PAPERS RELATING TO URETER CATHETERIZATION.

By F. Tilden Brown, M.D.

I. WHAT IS THE BEST METHOD FOR OBTAINING URINE DIRECT FROM THE URETERS FOR DIAGNOSTIC PURPOSES? *

THE invitation of your president to open a discussion on this topic was received with due appreciation. While admitting the keenest interest in all which pertains to the subject, I have wished that the honor had been allotted to someone who was sufficiently experienced in each of the several methods of renal differentiation to be surer than is the reader as to the accuracy of the following deductions.

With a prefatory understanding that the possibilities of these different methods are materially enhanced if he who manages the instrument has had a personal interest in its design or perfection, we are, nevertheless, entitled to expect that the ensuing discussion will show certain specific features associated with one method or another which will justify its acceptance as being the most generally advantageous.

It appears a fair proposition to assert that the best method for the purpose under discussion is:

1. That which is equally applicable to either sex.

2. That which secures the excretion of each kidney with the least risk of extraneous contamination.

3. That which causes the patient the least discomfort and carries with it the least chance of immediate or remote harm.

4. That which is most expeditious, simple, and universally applicable.

The surgical procedures giving access to the bladder, ureter, or

* A hitherto unpublished paper, read by invitation before the American Association of Genito-Urinary Surgeons at Washington, D. C., May 1, 1900.

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kidney for collecting separate urine are not considered pertinent. By consequence the review will be limited to: 1st, The Simon-Pawlick-Kelly method, most generally known by the last name; 2d, the Harris method; 3d, the ureter-cystoscope method.

1st. In the Kelly method the patient is preferably in the knee-chest posture, in order that gravity may lessen inter-pelvic pressure sufficiently to permit air to enter the bladder, and thus with its walls slightly separated to render detection of the ureter mouths easier. And in this attitude gravity also carries the incoming urine forward and upward away from the trigonum. When the urethra has been enough dilated to admit to the bladder a short straight tube of adequate size, this is suitably illuminated and one of the ureter mouths sought for in its usual position. When found and brought to occupy the centre of the visual field, it can be mopped with an antiseptic solution before the insertion of a metal or flexible woven catheter. The urethral tube being now withdrawn, the patient may be lifted from the knee-chest position into one upon the back or side, until completion of this collection, when she is repostured and the opposite ureter is sought for and treated in a similar manner.

The features of this method which appear disadvantageous are:

1st. It is practically limited to female cases. This statement is ventured notwithstanding the fact that the writer has seen Dr. Kelly catheterize one ureter in the male, the patient being in the knee-chest posture and under general ether anæsthesia.

2d. The essential position is a disagreeable one to a conscious patient and a tax upon the strength of an infirm one. The examiner is also in a constrained attitude, looking upward.

3d. The size of the urethral tubes ordinarily used is larger than that required in the other methods. Consequently more pain is to be anticipated.

4th. The number of assistants necessary is greater than in the other methods.

5th. There are several apparent reasons for employing general anæsthesia, and the disadvantages of gathering the renal excretion for accurate examination while these glands are having their normal functions influenced by ether or chloroform are manifest.

6th. When the ureter mouth presents well in the tube it is sometimes difficult to insert a flexible catheter because this receives inadequate support in the large urethral tube.

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7th. After a catheter has been passed to the proper two-inch distance the chance of its unrecognized displacement when the patient is being lifted to a lateral posture is to be considered.

8th. Even in the female the opportunities, whether to find the ureter mouths or inspect the bladder walls, are not as good as with the cystoscope.

On the other hand, some of the advantages of the method are:

1st. The armamentarium is a simple one. The instruments composing it are strong, easy to clean, and no damage is risked by long boiling.

2d. The mouth of the ureter and mucous membrane immediately about it can be cleaned before inserting the catheter.

3d. In some female bladder conditions this method might be the only one which offered a chance for separate urine collections, such as a vesico-vaginal fistula; and even in the male a vesico-rectal fistula would probably bar use of other means.

4th. Although not connected with the topic under discussion, it is, perhaps, permissible to say here that by this method lesions of the bladder-wall and foreign bodies in the female bladder can be dealt with as they cannot be by the other methods.

The Harris method demands no ureter catheter and nothing of the special sense of sight. It employs what may be likened to the two longitudinal halves of a severed silver catheter, where each is given a new side-wall, and they thus become two separate catheters. The shafts of these are held together by a long tubular collar, permitting independent rotation through an arc of 160 degrees. When the patient is in the dorsal position on a firm, level surface, and the bladder distended with a few ounces of boric-acid solution, the closed halves of the Harris instrument, now resembling an ordinary curved stiff catheter, are passed to the bladder. Here the two sections of the instrument are rotated outward and downward, the tip of each horn gliding along the mucous membrane until coming to a check over the ureter on its respective side. Then a metal lever is passed into the rectum in the male or vagina in the female and at a point equidistant from the two ureter mouths. This lifts the bladder floor so as to make a longitudinal water-shed; thus forming on each side two independent basins. The distending solution of boric acid is then allowed to escape through the catheters, thus instituting a syphonage action which continues to act as the separated urines of the two

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kidneys collect in their individual pools to be transferred to right and left specimen bottles.

In a goodly number of cases this very ingenious device of Dr. Harris's must afford data for correct diagnostic conclusions, but the fault of the instrument is that it does not enable one to determine which are such cases and which are not. A cystoscope examination must be first made to ascertain this fact. And since such an equipment is needed, why is it not better to use the same instrument for collecting the urine ?

There are several not unusual conditions where I would consider the use of the Harris method liable to give faulty returns, such as in the presence of a suspected vesical lesion, whether tuberculous, cancerous, hemorrhagic, or purulent, where the abnormal particles from any of these appearing in the syphoned urines might be erroneously ascribed to one kidney or the other. Again, prostatic outgrowths or tuberculous infiltrations of one of the seminal vesicles could prevent the lever from effecting an inter-ureteric dam, or could displace the ureter outlet in such a fashion as to allow admixture of the two urines.

But when the existence of renal disease is manifest, while any general evidence of vesical or urethral trouble is lacking, the successful application of Dr. Harris's instrument is probably the readiest means of getting the urines for examination.

In stating the following advantages for the method, the argument requires exclusion of cases in which the bladder is in any way abnormal :

1st. The instrument, while compact and portable, can be used in either sex by anyone who is fairly experienced with sounds or catheters, and a firm level table is its only needed accessory.

2d. The small cost makes its purchase for a single case reasonable. It is not easily injured, and it is readily rendered sterile ; although keeping its tubes and eyelets clear of dried muco-pus calls for attention immediately after use.

3d. Its employment does not involve the rather remote, yet possible risk of conveying infection to the ureters as appertains when a catheter is passed into them.

4th. The collection of the two urines is synchronous, and the time necessary for the total procedure is less by half than with any other instrument except the writer's double catheter-cystoscope.

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In stating the disadvantages of the method, the argument permits admission of all kinds of cases :

1st. The segregator is rather more difficult to pass into the bladder than the ureter cystoscope, while the subsequent manipulation and adjustment of its various parts involve more pain and greater risk of injury both immediate and remote. The writer has had a case of epididymitis following its use.

2d. By this method the position of a lodged calculus or stricture of the ureter cannot be detected as is so readily done by the ureter catheter used in the other methods.

3d. The value of culture tests is minimized or *nil*, since the renal excretions have a vesical contact in transit.

4th. Uncertainty attaches to the trustworthiness of the urines, because by the instrument's passage through the posterior urethra, or rotation of its arms in the bladder, a slight trauma may result and occasion bleeding, or some unsuspected lesion may have particles detached, which, when appearing in the collected specimen, might be incorrectly credited to the corresponding kidney.

In conclusion, we may say that while the existence of the instrument, more than that of any other, will probably lead to the examination of a much greater number of cases where differentiation of the urines is indicated, nevertheless the percentage of accurate diagnoses made by its use cannot be expected to compare with that which will accrue from ureter catheterization.

The third system, known as that by cystoscopic ureter catheterization, utilizes an optical instrument lighted by electricity, which is passed to the bladder containing some transparent medium—usually water—which serves to distend the vesical walls for observation and to keep the lamp from contact with them. The instruments of this system have a telescopic canal and a separate channel for conveying the ureter catheter.

The six ureter catheter-cystoscopes known to us are: Three of the convex type, Brenner's, Boisseau du Rocher, and the writer's, together with three of the concave type, Caspar's, Nitze's, and Albarran's.

Although all of them have certain characteristics sufficient to give them individuality, they aim at the same general method of getting urine from one or both kidneys.

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In the convex, or direct, type the catheter and telescope present near the convex junction of the shaft and tip of the cystoscope. Fig. 1, A, B, C.

In the concave, or indirect, type the catheter and prismatic telescope present near the concave junction of the shaft and tip.

With the former it may be more difficult to see the ureter mouths, but once detected they are more easily entered by the catheter; while with instruments of the indirect class just the reverse

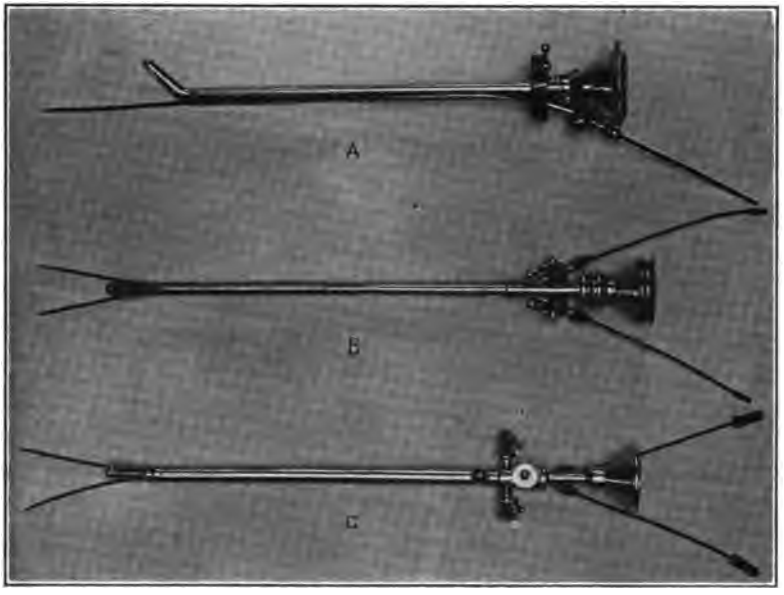

FIG. 1.—*A*, Brenner's Single Catheter Cystoscope; *B*, the writer's original double Catheter Cystoscope; *C*, the writer's present Double Catheter, and two-way Irrigation Cystoscope.

is more apt to be true. In other words, the oblique angled view of the ureters had through the direct telescope is not as generally satisfactory as the bird's-eye view given by the prismatic telescope; and the reason why catheter management is more difficult in the latter type is because: First, the catheter must conform to the double curve on entering and leaving its canal. This causes it to bind. Secondly, the prismatic telescope, because it not only inverts the image but gives no perspective, leaves the examiner in doubt as to whether the tip of the catheter is an inch away or all but in touch

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with the ureter mouth. There is one other consideration attaching to these two classes of cystoscopes, the former can be used effectively for ureter catheterization with less distention of the bladder than is necessary for the latter. This is readily seen because the concavity of a bladder will permit a convex body to effect a closer conformation without contact than could a concave body of the same size.

This matter of distensibility is of much importance. I have several times catheterized the ureters with a convex instrument when the bladder could not tolerate more than forty-five cubic centimetres of fluid; and to have done so with a concave instrument, I believe, would have been impossible.

The disadvantages of this method are:

1st. It is not practical where the distending medium cannot be made fairly transparent, or where this does not amount to more than one ounce.

2d. By it the distending fluid is dammed up in the bladder, causing, in some cases, discomfort, and leading finally to a painful expulsion of it around the cystoscope.

3d. The instruments are relatively expensive and require much care. Until recently it has been necessary to send them abroad for even minor repairs.

4th. To acquire the details of the method and apply them effectively demands more persistent practice than most surgeons have the inclination or time to devote.

5th. It is open to the criticism of endangering infection of the ureters, although the writer has never seen it occur.

6th. Many cases of prostatic enlargement, and others of marked nodular cystitis where the ureter mouths can easily be concealed between these mounds, besides any form of growth barring the entrance of a ureter might reasonably be expected to render this method impracticable, and, for that matter, any of them.

On the other hand its advantages are:

1st. It is applicable to either sex, and permits of examining the bladder as well as seeing a renal hematuria or pyuria, besides collecting the separate urine through the catheter, or, if this cannot be done, the cause of failure can be recognized.

2d. It is accomplished with the least discomfort to the patient, a general anæsthetic being very rarely necessary.

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3d. The opportunity afforded by it for examination of the bladder may serve to show the existence of an unsuspected vesical lesion which adequately explains the clinical symptoms and shows that ureter catherization can be deferred or wholly dismissed.

If the propositions prefacing this discussion are to be accepted, it appears to the writer that we may conclude the best method of collecting the separate urines to be that by means of the ureter cystoscope. But we are to have the pleasure of listening to the opinions of several who have had wider experience with the Kelly and Harris methods than the writer.

As to the relative advantages of the two different types of ureter cystoscopes, our personal experience leads us to strongly favor the simpler one, *viz.*, the convex, although there are exceptional cases where the other may be requisite for success. What we have said in a former paper ("The Differentiation of the Urines," *Annals of Surgery*, 1899, p. 661) about the individual merits of all these different instruments still holds good, in our estimation. At that time we were working in an experimental spirit with the various catheterizing cystoscopes, and concluded that the original Brenner met the requirements in the majority of cases better than did any of the others. In arriving at this, not only were the catheterizing possibilities at the vesical end of the instrument taken into account, but the ease of controlling leakage and the management of the catheter at the ocular end, as well as ease of cleaning the cystoscope.

One reason why the tendency to leakage is less in one type of ureter cystoscopes than in the other is because of the difference in the angles at which they are held in relation to the horizontal plane of the patient's body, and for this same reason the slight inclination of the indirect type puts a good deal more tension on the suspensory ligament of the penis.

It was with the purpose of enhancing the usefulness of Brenner's instrument that we had Leiter make the original double-barrelled ureter cystoscope (Fig. 1, B). This was presented more than a year ago, but as it is probably unknown to some of you, I shall ask this opportunity of showing it again. The idea of the second catheter canal was suggested by an appreciation of the disadvantages already mentioned, No. 1 and No. 2, attending the cystoscopic method of collecting the urine, *viz.*, where the distending medium was too

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rapidly rendered turgid by the admixture of pus or blood. And again because it was impossible to let the distending fluid out of the bladder while the catheter was collecting urine from the ureter. By adding another catheter canal to the Brenner instrument it appeared that these requirements could be met. In order to keep the cystoscope still of the same circumference, space was to be economized by a different setting of the lenses and by making both catheter barrels smaller than the one in the original.

Besides utilizing the second canal for irrigation or evacuation while the first was occupied by a catheter continued into one ureter, it would be feasible by it to gather the other kidney's urine indirectly from the bladder. Moreover, it was thought possible, in exceptionally favorable cases, to use both barrels for catheters and to pass one immediately after the other, thus collecting the individual urines synchronously. A protracted illness prevented much work with the instrument, but enough has been done to prove its employment in this last way practicable to a greater extent than had been anticipated.

When so utilized, however, there is again no passage for evacuating the bladder, just as was the case with the Brenner; still the advantages of having one extra canal for irrigation in difficult cases, and in easy ones of being able to collect both urines at the same time, are so material that the sacrifice to this end of the original purpose of the second barrel convinces me that in the future any device which does not provide for such synchronous collection as a routine measure must be considered antiquated.

2. THE TECHNIQUE OF BILATERAL CYSTOSCOPIC URETER CATHETERIZATION WITH THE WRITER'S COMPOSITE CYSTOSCOPE.

While ureter catheterization will always remain an arduous undertaking and probably never be practised even by a small minority of the great number who are coming to an appreciation of its value, nevertheless, since our profession avoids no new field of labor, however arduous or unremunerative financially, and because some enthusiasts are only stimulated by the recognition of difficulties in the accomplishment of anything conducive to the welfare of humanity or the advancement of science, the work is sure to progress. The writer believes that there are not a few who have read much on the

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subject in hand, and that while some of them have been tempted to take up its practical application, they were only deterred by a dearth of simple data regarding the necessary armamentarium and the method of utilizing it. Others, again, may have found themselves misled after attempting with various devices to verify the claims of

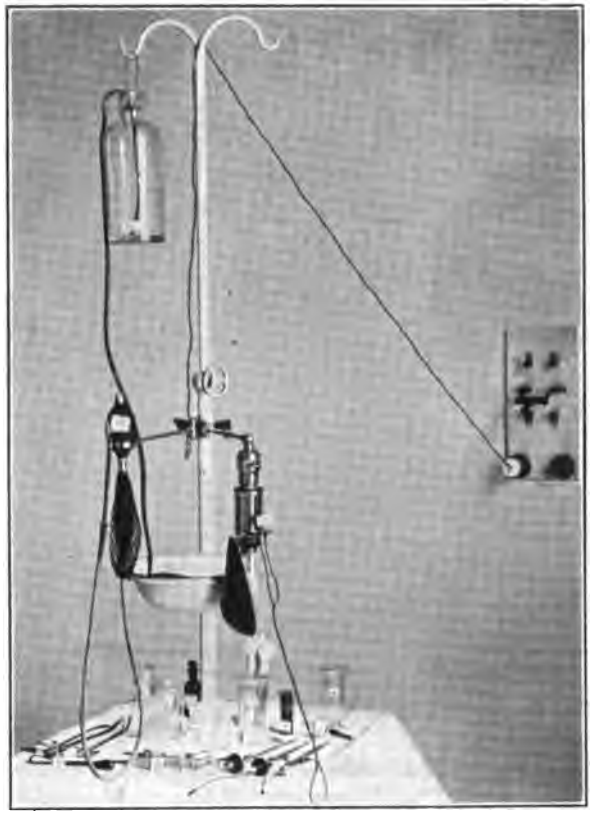

FIG. 2.—A Hold-all Table to stand at right hand of the Examiner.

the originators that an easy, safe, and accurate method for collection of the separate urines had been perfected. Lest any should have such a disappointing experience at our instigation, we wish to say that mere possession of a perfect instrumental equipment may not insure an immediate successful application, and that unless the would-be cystoscopist approaches the subject as a painstaking student, attentive to every particular and prepared for some discour-

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agement, he is pretty sure to regret his wasted effort. Mainly for the benefit of those who are actual novices, the writer will aim, by the aid of illustrations, to make clear his method of synchronous cystoscopic ureter catherization by the appliances here presented. While the cystoscope is more complicated than his original one (Fig. 1, B), for double ureter catheterization it has a greater range of efficiency, not only for that particular purpose, but for use as a direct and prismatic examining cystoscope as well.

When every piece of apparatus which may possibly be needed during an examination has been properly arranged in easy reach of and under control of the right hand alone (Fig. 2), one may hope to be able in most cases to carry the séance to a successful conclusion without the aid of an assistant. The left hand is not to be counted on for help except for its single duty, but that a continuous and tiresome one, namely, to retain control of the cystoscope once this has been passed. Consequently the position of the patient's right leg on the table must provide to leave space for an occasional resting-place for the upper ulnar surface of the examiner's left forearm.

The gentleness with which the cystoscope is moved, and the steadiness with which it is held, have much to do with successful results.

A review of the implements and the other features to be considered in conducting an examination will be taken up seriatim and referred to very much in the order that their use entails.

The examining room should be light enough to facilitate all the preliminary steps, and darkened moderately only when the cystoscopic lamp is illuminated. A room with a single window at the back of the examiner and provided with a dark green roller shade is most convenient.

An appropriate dress for the patient consists of a warm body wrapper, while a pair of long woollen or Canton flannel laparotomy stockings, secured to a waist-band, cover the feet and legs. Felt shoes or worsted slippers are well added. When the patient is postured, sterile towels are spread over the abdomen and legs.

Since a secure and easy repose for every part of the body adds so much to the tolerance of the patient as well as to the prospect of success for the examiner, a table affording every requisite for suitable posture is of the first importance, especially where one expects to have patients of all ages and shapes. The Kny-Scherer Com-

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pany make such a one, fitted with the writer's leg-rests and some other modifications (Figs. 3 and 5). This has a tilting range from the horizontal in either direction of more than forty-five degrees, and is adjustable by an easy-working hand crank which is self-securing at any pitch. The back-rest is movable in two directions; in the first place upward from the plane of the table by a hinge,

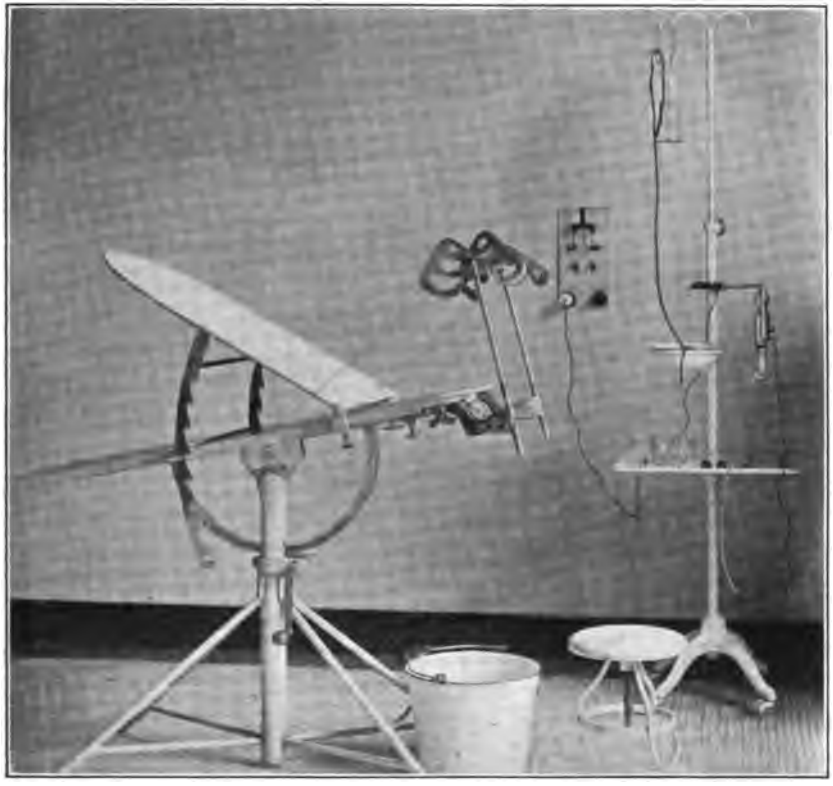

FIG. 3.—Table as arranged when holding an Adult for Ureter Catheterization.

and again forward or backward on the table by a binding groove. This latter adjustment is important, since the patients may vary greatly in size, and all should be postured with the buttocks as near the foot of the table as is compatible with seating space. At the same time support should be given to the back, not alone at the dorso-cervical, but at the sacro-lumbar region as well. Very few surgical tables make any provision for this; consequently if the

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lower part of the patient's back is given any consideration, such a requisite has to be supplied by the use of cushions.

The mechanism of each leg-rest can be likened to that of the human upper extremity, with an upper arm, elbow, forearm, and a crutch to represent the hand. This crutch is a double inclined conical gutter, the apex of which conforms to the flexure of the knee, and either the thigh or calf receives the greater support according to the height and inclination of the forearm. This latter is a cylindrical steel rod which when unclamped can be raised, lowered, or turned. This clamp in turn is part of a hinged elbow affording flexion and extension. Any angle of the elbow is maintained by a heavy spring bolt in the upper arm, which latter is susceptible of abduction and adduction by the loosening of thumb-screws binding it to the under surface of the table. By these means a child can be as comfortably postured as an adult; whereas without this provision for approximation of the leg-supports, the short thighs of the child, even with the fullest abduction, could not be brought to reach them.

Fig. 3 shows the bare table arranged and tilted as when supporting an adult for ureter catheterization.

Fig. 4 shows the patient and examiner in position. Note that the electric-light cord attached to the cystoscope has a resting-place on the patient's left thigh; this is to prevent even the traction of its own weight upon the cystoscope which might embarrass its manipulation. The irrigating tube has a somewhat similar position; and when not attached to the cystoscope hangs pendant only a few inches from the instrument, being at hand to relieve any increasing turbidity of the bladder fluid; when the employment of air inflation is anticipated the tube leading from the bulbs should be given a corresponding place of accessibility.

Although foreign to our topic I would here call attention by Fig. 6, to features of the table, making it an exceptionally favorable one for conjoined surgical supra- and infra-pelvic approach, whether the patient be in the prone or Trendelenburg position. Most operating-tables providing for this latter position have a continuous metal apron over which the legs are secured in adduction, and which seriously impedes any infra-pelvic access.

For irrigating utensils we have found graduated glass cylinders or bottles which are drawn from by syphonage to be the most convenient. An inverted U metal tube leads the continuous rubber

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tube over the rim of the irrigator. A split in the U admits of sinking any part of the rubber tube into this gutter, while it binds the tube just firmly enough to prevent occlusion by weight of water in

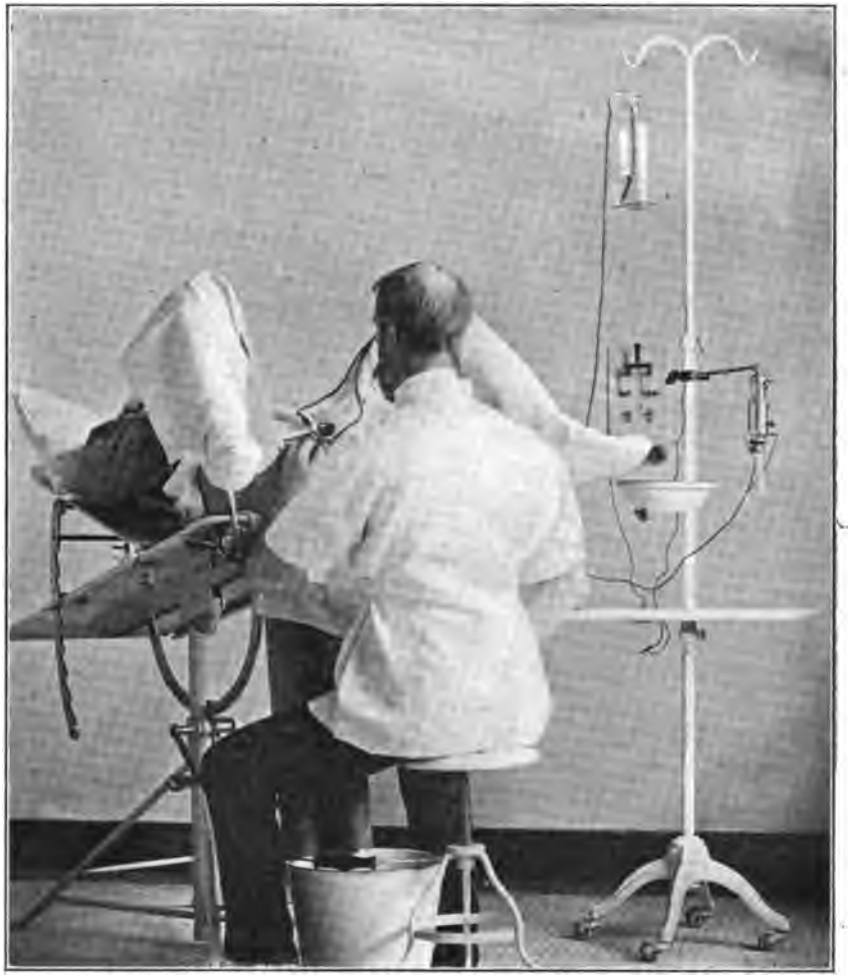

FIG. 4.—Patient Postured for Ureter Catheterization.

the long arm. A metal cone nozzle which fits the water-ways of the cystoscope and catheters and having a finger-cock, completes the apparatus. If one is careful not to exhaust the syphon, the tube

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FIG. 5.—Table in Trendelenburg position, showing mechanism of Under Surface and Leg Rests.

is always ready for action. It is an easy thing to boil, being in one piece and unattached.

If considered necessary, a small bulb can be given a place not far from the nozzle to start an exhausted syphon, but it is more in the way than a help.

The fluid used for irrigation is generally a two-per-cent. warm

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boric-acid solution. If the bladder is very irritable, equal parts of salt solution and four-per-cent. boric is preferred. Only the best preparation of boric acid will make a transparent solution, and even such will improve by twelve hours' standing. It is our custom to dissolve 160 grams of Squibb's preparation in 4,000 cu. ctm. of

FIG. 6.—Patient Postured for Conjoined Supra- and Infra-pelvic Approach.

hot sterile filtered water and keep the same ready for use in a glass covered cylinder jar, drawn from by a tap. These are made to order by Whitall & Tatum, New York. As the solution is one of four per cent. and cold, hot water or hot salt solution is blended with it in the irrigator just before use.

Adequate anæsthesia, except in the cases of nervous children,

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can be had from a four-per-cent. solution of cocaine. Of this we aim to use as little as possible. Three cubic centimetres in the urethra, and from four to ten in the just emptied bladder, will usually suffice. We know of some who do not hesitate to use three or five ounces of a similar solution of cocaine in the bladder and a solution of eight or ten per cent. in the urethra. A good one-hand sterilizable syringe with a tight yet easy working piston is essential.

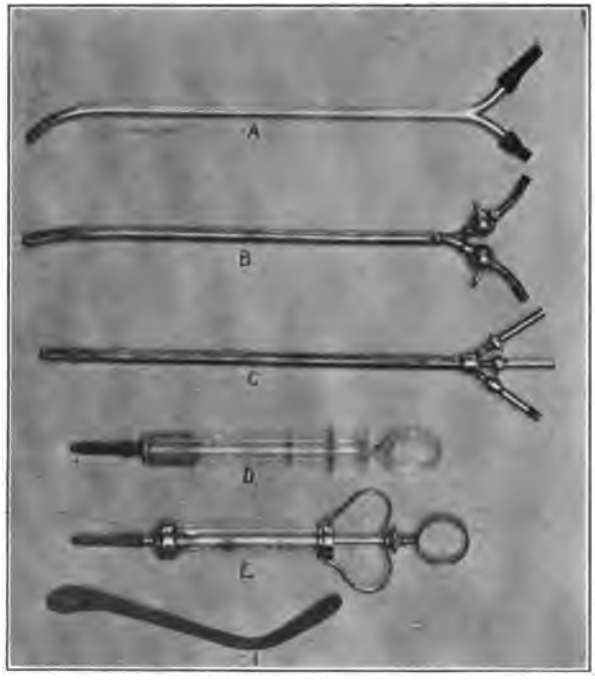

FIG. 7.—*A*, *B*, *C*, two and three-way Curved Silver Catheters; *D*, Randall-Faichney Company Syringe; *E*, the Kny-Scheerer Company's (Carlton) Syringe; *F*, the Writer's Rectal and Vaginal Elevator.

The two shown in Fig. 7, *D* and *E*, meet these requirements. One which is all glass with an asbestos packing unaffected by repeated boiling and with this double finger flange, is made for us by the Randall-Faichney Company, of Boston. The other, known as a Carlton syringe, is made by the Kny-Scheerer Company, of New York. In this the piston is of rubber, and adjustable by a screw flange. The latter syringe costs about twenty times as much as the

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other. As the small hand syringe will be needed for other purposes than the injection of cocaine solution into the urethra, it is advantageously capped with a rubber tip, and one the lumen of which will make a snug fit over the short ureter catheters, since it is well to test their patency before using, and the outer conical surface of the same tip must fit with equal facility into the conical ends of the long ureter catheters, various parts of the cystoscope, or the bladder catheters.

Since these same rubber tips when cut down to a half-inch length make the air- or water-tight connection between the ureter catheters and their respective nozzles on the cystoscope, it may be seen that they come under the head of very important trifles (Fig. 9, *D*). They are all so uniformly moulded that the extreme end just fits over the ureter catheter of five millimetres circumference. They can be bought of Whitall-Tatum Company, New York, at sixty cents a dozen.

The necessity of cleansing the bladder and urethra before distending the viscus with water or air for examination brings us to a consideration of the various means of doing this. Of course, the patient voluntarily voids urine immediately before going on the table, and this specimen is retained for contrast examination with those yet to be collected from the ureters. Now, the urethra is anæsthetized by cocaine, when we may pass the rubber catheter (*C*, Fig. 8) and draw any residual urine before proceeding to irrigate the bladder; or we may prefer to take a two- or three-way-channelled catheter (Fig. 7, *A*, *B*, *C*), the curve and circumference of which is about the same as that of the cystoscope. In general, the indications for using one of these latter forms of catheter would be a urethra hitherto unexplored, or where spasmodic opposition is known to exist. Again, where a more effective washing of the bladder is indicated or a special amount of cocainization necessary in the posterior urethra, for, with the three-way catheter, while two of its eyes may be exposed in the bladder—carrying on a more or less continuous irrigation—the third eye, which opens some inch and three-quarters farther forward, will be exposed in the posterior urethra, and by it cocaine or adrenalin solution can meanwhile be intermittently deposited in this part of the canal to check irritability or bleeding, and immediately upon the withdrawal of the rigid catheter the cystoscope will be more apt to pass through an irrita-

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ble urethra than would be the case on removal of a flexible one. While, with the present irrigating facilities of the composite cystoscope, these short-beaked, rigid catheters may not be used once in a dozen cases, they should always be at hand, ready for employment, in male patients, rather than resort to any force in introducing the cystoscope. These catheters are made to order by Wappler Brothers. At times Janet's method of irrigation offers advantages, especially when preliminary urethral cleansing is indicated as well as when the vesical capacity is considerable and where the urethral behavior is favorable to its employment.

The cystoscope here presented is the result of the successful attempt to add two irrigating canals to my former double-catheter-carrying instrument (Fig. 1, *B*). While that had its prototype in Brenner's single catheter-cystoscope (Fig. 1, *A*). On finding it feasible to catheterize both ureters at the same time and so get a more accurate expression of the separate renal conditions and functions than had attended the consecutive method antedating it, we saw that an instrument, if of no greater circumference, which would admit of irrigation or evacuation of the distending medium would add materially to its value. After some experience it was clear that in order to economize sufficient space for the purpose desired, the terminal window, the setting of which took relatively a large area, must be discarded. By doing so we could utilize the two triangular crevasses between the telescope tube and the two catheter tubes as irrigating channels. But without a window a hiatus was left at the heel of the cystoscope, rendering its introduction unsafe without an obturator, which must be withdrawn before giving place to the catheterizing telescope. Such a scheme at first appeared disadvantageous, but, as obstacles were overcome and new features added, we found ourselves possessed of a combination cystoscope where one common sheath performed the light-carrying and irrigating requirements for three different telescopic tubes. The sheath, once in the bladder, made interchange from one telescope to another painless and quick, while irrigation with or without a telescope in the sheath was facilitated. The method seems to offer a new line of departure for cystoscopic advancement, in that a number of parts can be added to the present equipment, such as an application telescope, a prismatic double-catheter telescope, an operating telescope, or one which looks backward. In the evolution of the composite cysto-

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scope, the writer takes pleasure in accrediting Mr. Reinhold Wappler with everything having to do with the quality and system of the lenses which make the visual qualities of the different telescopic parts so satisfactory, and we cannot speak too appreciatively of the ready interest with which the maker has met our demands for vari-

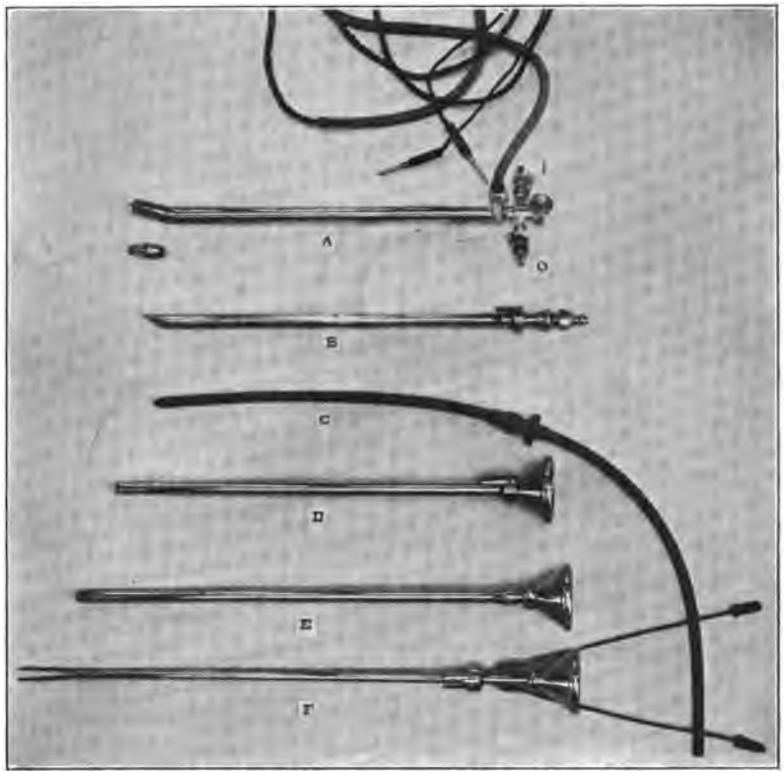

FIG. 8.—The Writer's Composite Cystoscope; *A*, Sheath carrying the Inlet and Outlet Cocks, also Terminal Lamp; *B*, Obturator; *C*, Rubber Catheter with Adjustable Cork; *D*, Direct Telescope; *E*, Prismatic Telescope; *F*, Catheter Telescope.

ous alterations, while his finished artisanship is manifest enough to occasion satisfaction that we no longer have to turn to Europe for this class of work.

The various parts of this cystoscope are shown in Fig. 8. *A* is the sheath, made of two very thin tubes, one overlying the other, between them the insulated connection, running from the electric

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screw-post to the lamp, which is of the high efficiency, or "cold," type, requiring but 0.18 ampère and four volts to light it. Further reference will be made to the lamp in connection with the prismatic telescope. The only other essential parts of the sheath are two elbowed stop-cocks for inlet and outlet of water or air. The inner apertures of these cocks are opposite one another and flush with the lumen of the sheath. A binding-screw for holding any of the telescopes against their collars to prevent leakage is also seen. The length of the sheath from electric screw to the face of the vesical lens is six and a-half inches. The circumference is 24 mm., and the calibre 21 mm.

Some have ordered the instrument made an inch and a-half longer, and another calls for it two inches shorter; the latter is intended evidently for exclusive use in the female. The writer feels convinced that he has selected the most appropriate length for the greatest number of cases in both sexes, and that when the owners of an eight-inch instrument use it in the female so large a part will extend from the patient's body as to be uncomfortable to control, while the ease with which the male urethra can be telescoped on the instrument allows a 6½-inch shaft enough and to spare in reaching any male trigonum.

B is the obturator which is essential for the safe and easy insertion as well as withdrawal of the sheath. Tubes or grooves in the obturator corresponding with the inner opening of the elbow cocks permit of cocaine or lubricant instillation or of vesical irrigation before its withdrawal, but since irrigation can be so much more effectually done by *C*, a No. 16 French soft rubber catheter with a movable rubber belt, which acts both as cork and washer, it is better to remove the obturator at once. If the bladder has received no washing prior to insertion of the instrument, just as soon as the obturator is removed some seven inches of the catheter, *C*, is substituted for it, and corked in the sheath. The irrigator is now connected with the catheter and after two or three ounces of solution has entered the bladder, the exit cock is opened, and the irrigation now made a more or less continuous one. If the bladder is somewhat atonic and the last few ounces tardy of expulsion, it is well to disconnect the irrigator and to use the catheter itself as a syphonage-exhaust.

With a return of transparent irrigating fluid, if the bladder needs

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no further cocainization, any one of the three telescopic tubes can be passed, and the irrigating tube now connected with the inlet cock. After an ounce of fluid has entered the bladder the lamp may be illuminated and observation begun while the bladder is still being distended to the necessary extent.

Even where catheterization of the ureters is the ostensible object of the examination, it is no hinderance, but rather a gain, to make use of both the direct (*D*) and prismatic (*E*) telescopes before inserting the catheter-telescope (*F*), since, because of the better illumination and larger visual field in the two former, any abnormal conditions pertaining to the ureter mouths or the bladder at large can be more quickly observed. When any of these telescopes is withdrawn a trifle so that the vesical end has come wholly within the sheath, the latter can itself be slightly withdrawn until the heel opening comes just to the internal meatus; by now raising the ocular end to more or less of an angle with the plane of the patient's body, the distending medium in the bladder will be prevented from escaping while the telescope is wholly removed, and the next telescope, when well within the sheath, calls for a lowering of the ocular end, so as to prevent impact of its vesical end upon the neck of the bladder. After a little practice, one can make such changes with perfect success and thus save the time otherwise required for a renewed introduction of distending medium with each succeeding telescope.

We are now ready to pass the ureter-catheter telescope which has been previously prepared with a capped catheter in each canal. The ureter mouths and the surrounding "landmarks" have perhaps already been noted by the direct examining telescope, perhaps by the prismatic as well, so now their identification will be all the more readily done by the catheterization telescope, or, if by the time this has been inserted, the distending fluid is seen to be lacking in transparency, the irrigating apparatus is again connected at *I*, and the cock at *O* opened, and, while a cleared medium is being effected, the ureter mouth or its evident position is ascertained, then the corresponding ureter catheter has only to be advanced less than an inch to engage it, and passed slowly for two and a half inches. While maintaining the cystoscope in exactly the same horizontal inclination, the ocular end is slowly moved in a lateral direction through an arc of thirty to forty degrees, depending upon the distance between the ureters and the distance of the ocular from the

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pivotal point of the cystoscope in the urethra. By attention to this deliberate movement the catheter already passed will cause no undue tension on the ureter mouth, and the opposite ureter will be recognized with greater certainty and celerity than was the first. Here the second catheter is passed in the same careful manner, and not of necessity deeper than two inches, because the cystoscope will be carried back through a lesser arc to the median line, there giving each catheter the same degree of curvature. The caps are taken from the ends of their catheters, and the urines collected in bottles marked "right" and "left." While so issuing, five or six drops of each urine is permitted to fall upon the appropriate media in labelled culture-tubes. The outlet cock, *O*, is now opened and more or less of the distending medium permitted to escape. This affords repose to the bladder. Although by this instrument the opportunities to leave the catheters in the ureters while the cystoscope is removed are facilitated, it is our routine practice to hold the cystoscope carefully in place during the collection of the urines. There are exceptional cases to be mentioned in considering the subject of catheters where these latter are preferably left after removing the cystoscope.

D is the direct observation telescope. It affords a large visual field, which is unusually well illuminated, because of the proximity of the lamp and distal lens. Irrigation with *D* in place must be intermittent to avoid short-circuiting of the medium in the sheath.

E, the prismatic telescope, is wholly unlike the instruments we have so long used for gaining a bird's-eye view of different surfaces of the bladder. In them the window is at the concave junction of the tip and shaft, some distance behind the lamp, while here it is at the extremity of the telescopic tube, immediately below and close to the lamp. The lamp and window can be turned in the bladder conjointly or independently. The new feature of being able to use the lamp (a cold one) as a probe or feeler on tumors, prostate, or foreign bodies while watching its behavior, as such, with the telescope, is a striking advantage. The opportunity to view objects behind the lamp and window is also much better. A hoodless lamp set only in a metal collar was made particularly for use with this telescope. Since it will stand a weight of twenty pounds and illuminates the bladder just as well for the other telescopic tubes, we have come to use it rather exclusively for all, although the working of the prismatic tube does not demand this especial lamp.

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The ureter catheters (Fig. 9, *A*) for this instrument cannot have a circumference greater than 5 mm. The most convenient length for urine collection we find to be 36 ctm. (14 inches). The best catheters we have had of this type for synchronous employment are of domestic make and sold by the Kny-Scheerer Company. Their superiority consists in a happy combination of rigidity and flexibility, the former being sufficient to overcome the opposition sometimes offered by the sphincter of the ureter, while the latter quality

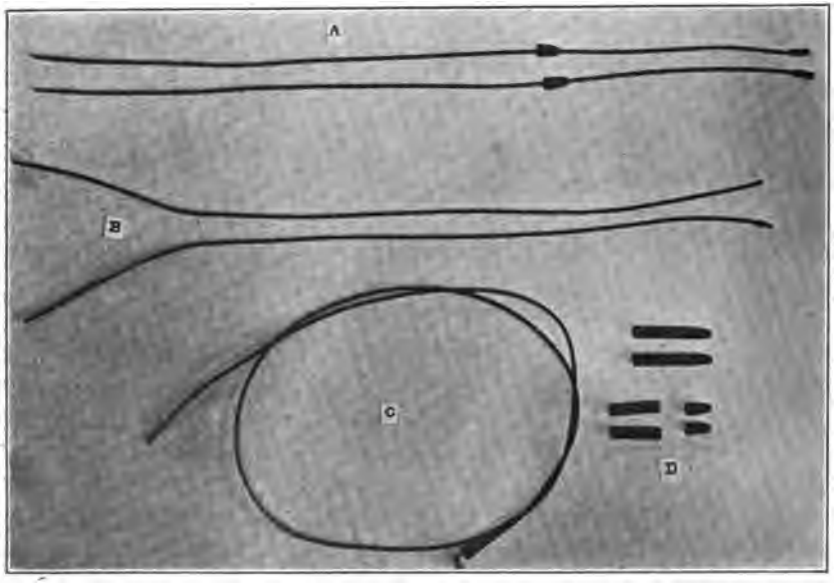

FIG. 9.—*A*, Pair of American Ureter Catheters (fourteen inches long) with Collars and Caps; *B*, pair of similar Catheters which show the characteristic angulation given them by being in the Ureters; *C*, European Ureter Catheter, twenty-eight inches long; *D*, Rubber Syringe Tips, and the same cut to make the Collar Washers for Catheters.

permits such an easy bending that no undue leverage is put upon the ureter mouth when, after a catheter has been passed into it, the cystoscope is turned away to pass the second catheter on the other side.

If at once well cleansed after removal, and moderately stiff stylets passed into the catheters while being sterilized with formaldehyde vapor they may be safely used several times, although it is not easy to have them regain their original firmness and shape. So prone are they to retain a particular curve after resting for a few minutes in the ureter that one would only have to glance at a cathe-

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ter to determine whether it had been where intended or lying curved in the bladder. Fig. 9, *B*, shows this characteristic curve in a pair of catheters which had been used for the first time two days before, and not afterward straightened by stylets and pulling.

The long European catheters (Fig. 9, *C*) are only used if the more or less continuous drainage of a hydronephritic kidney is indicated, when the cystoscope is, of course, removed; or they are employed to measure the distance of a stricture or a lodged calculus, or, again, to determine whether some abdominal tumor is or is not a displaced kidney. In such cases, after the catheter has been fully passed, then its stylet is inserted and a radiograph taken (Fig. 10).

The "cold" lamp now makes it perfectly safe to use air for vesical distention in cystoscopy. It is not yet, however, found to be a satisfactory substitute for water. Although the writer was an early advocate of the use of this medium for surgical access to the bladder (*Annals of Surgery*, 1897, p. 141), and while he had hoped for much from it in cystoscopy, the expectation has not been realized. The main objections are that it is startling and painful to the patient, and by it the little urine gradually accumulating in the bladder is apt to be stirred up into foam, or minute drops of this are splashed on the lens.

It is not improbable that the crude method by which air is at present conveyed to the bladder is mainly responsible for these results. The apparatus in vogue is a pair of rubber air-bulbs, such as accompany the Paquelin cautery. Atmospheric air of ordinary temperature is forced into the reservoir bulb, from whence under considerable elastic pressure it is allowed to rush into the bladder. By such a liberation it reaches the warm viscus at a still more reduced temperature, and it is quite reasonable to believe that this and the suddenness of impact are sufficient to cause shock and discomfort. We have a device partly completed which aims to slowly propel a measurable quantity of warm air to the bladder. If satisfactory it shall have future mention.

When electric illumination can be had from some good source, a rheostat or controller is needed to reduce the electromotive force to one safe for the small lamps of the cystoscope. Such a one, made by the Wappler Brothers, is shown in Fig. 11. This is a device to be inserted directly into an electric lamp socket when a derived current is obtained from the two binding posts whose voltage can be

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FIG. 10.—Radiograph of Metal Stylet in Ureter Catheter to prove the Kidney in Normal Position.—Drs. A. B. Johnson and the writer.

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varied from a fraction of a volt up to forty, while the amperage capacity is limited by the particular lamp in the controller approximately as follows: 16-candle-power lamp, ½ ampère; 32-candle-power lamp, 1 ampère; 50-candle-power lamp, 1½ ampère.

Before introducing the cystoscope, its lamp should be given the proper grade of illumination by the button (*c*) on the controller, then extinguished by the switch, while this latter is the ony thing touched after passing the instrument.

FIG. 11.—Wappler Current Controller with movable shade behind the lamp; *C*, turn-button for grading the Voltage.

Often a portable storage battery must be depended upon in out-of-the-way places. A battery of four dry cells, one and a half volts each, is sufficient for these newest high-efficiency lamps. The cells can be bought of any electric-supply dealer at thirty-five cents. A small rheostat is essential, which is placed in the lid of a compact inexpensive case made by the same firm.

Six cubic centimetres of urine from each kidney is the smallest amount which permits of a fairly complete examination, and twice as much is better. A Westphal balance is the most convenient appliance for accurate specific gravities of these small quantities.

For filing with the histories of cases a form of analysis blank is more suitable if the test returns for the ingredients of the three separate samples are shown on a single sheet.

Better than any of the artificial bladders made for the practice of cystoscopy are those removed from the bodies of both sexes, and suspended in a two-per-cent. solution of formalin, five or six ounces of the same being used to distend the organ. In removing a bladder, one inch of urethra and three of each ureter are a proper

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allowance. Very small bougies should be passed through the ureter stump so as to have their sphincters remain a bit patent when hardened and bleached, otherwise these canals will be both difficult to recognize and impossible to enter with the catheter. When taken from the jars for practice, the formalin solution is poured out of the bladder and replaced by clear water or air. In order to have the viscus retain a steady position while manipulating the cystoscope, it is well to pin with small staples to a cork or wooden block which has had a concavity made in it for the reception of the base of the bladder. A series of such bladders will illustrate very well the many changed conditions one has to expect in performing cystoscopy and ureter catheterization in the living subject.

In Fig. 7, *F*, is shown a rectal and vaginal elevator by the aid of which catheterization can be accomplished in some otherwise impossible cases. By reference to Figs. 12 and 13 one may see the two extreme types of bladder alluded to in a former paper (*Annals of Surgery*, 1899, p. 661) as those of the horizontal and vertical tri-

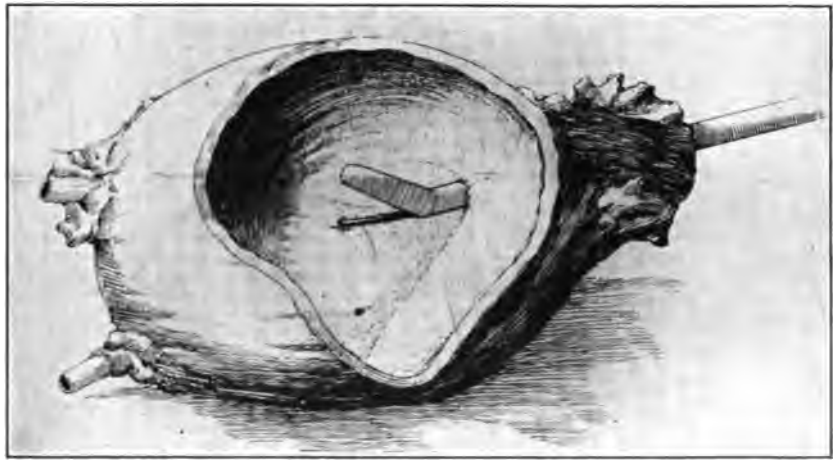

FIG. 12.—The Horizontal Type of Bladder.

gonum and having to do with the relationships of the internal meatus and ureter mouths. In the former, the three orifices are on nearly the same level, and in which to engage the catheters in the ureters the shaft of the cystoscope approximates to the horizontal plane of the body, while in Fig. 13 the three orifices are on a very different level, the ureter mouths being three-quarters of an inch or

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more below that of the ureter and occupying a sort of crease between the posterior and perpendicular inferior wall of the bladder. And here, in order to see the ureter opening, the shaft of the cystoscope must be raised to an angle of fifty to seventy degrees with the horizontal plane of the patient's body; while to enter them with a catheter it is sometimes necessary to obliterate the crease in which they lie by lifting it and stretching it away from the internal meatus so as to more resemble the horizontal type of bladder. These verti-

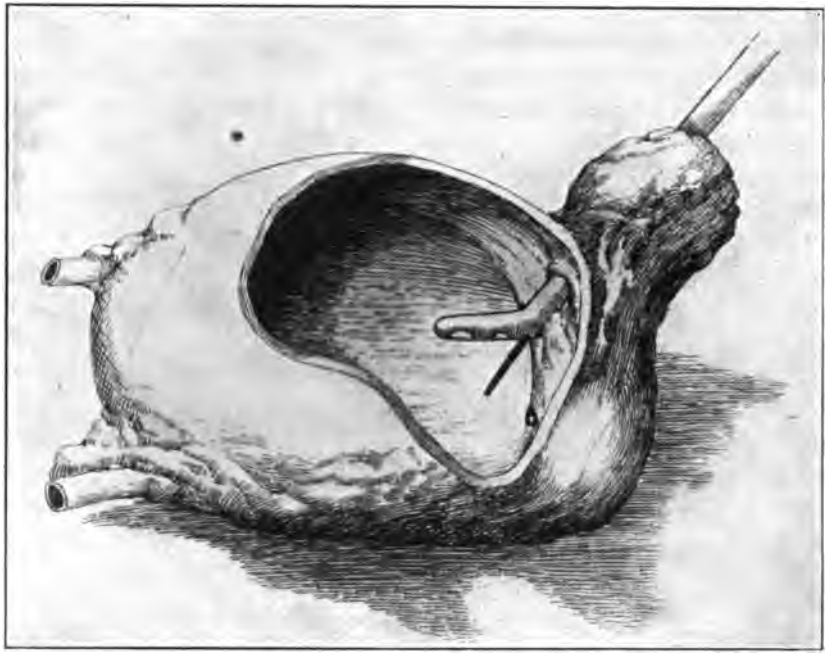

FIG. 13.—The Vertical Type of Bladder.

cal bladders are about equally common in both sexes, and when encountered in one the conical end of the elevator (Fig. 7, *F*) is brought to bear on the anterior vaginal wall in front of the cervix; while in the male it bears upon the anterior rectal surface just opposite the upper margin of the right or left lobe of the prostate. Since the examiner is controlling the elevator with one hand and the cystoscope with the other, an assistant must here be called upon to advance the catheter when its alignment with the ureter is seen by the examiner to be just correct.

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VII.

A REPORT OF TWENTY-TWO CASES OF ABSCESS OF THE BRAIN.

By John W. Coe, M.D., and Burton J. Lee, M.D.

In Volume III., 1898, of "The Presbyterian Hospital Reports," Dr. E. S. Steese reported 15 cases of abscess of the brain on which autopsies had been held. Since that publication there have been 3 additional cases, and the records show 4 earlier ones which were not included in his list, there having been no post-mortem examinations.

There have been treated 45,893 patients from the opening of the hospital, in October, 1872, to October 1, 1901, making the proportion of cases of abscess of the brain to all diseases 1 to 2,086. During the same period the total number of autopsies has been 2,207, of which 17 have been found to have abscess of the brain; a ratio of 1 to 129.

Pitt, in the Goulstonian Lectures for 1890, reported, from 9,000 autopsies at Guy's Hospital, 18 cases of abscess of the brain following ear disease—a proportion of two-tenths of one per cent., or 1 to 500.

In our list of 22 cases there was only 1 during the first nine years after the opening of the hospital; during the next decade, 2, and between 1891 and 1900, 18. This rapid increase is probably accounted for by the improvement in diagnosis, and a similar state of affairs has been noted by many writers of recent years. Following is a table of the seven cases which we have been able to add to the fifteen already reported.

In discussing the table we shall also include the cases previously reported.

ETIOLOGY.

By far the most prominent factor in causation of the abscess was traumatism, 11 and probably 12 being directly attributable to an injury to the head. Of these there was a fracture of the skull in 7; in

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Case No. Initials, Age, Sex.	Social Condition.	Nationality.	Occupation.	Admitted. Discharged.	Etiology.	History.	Physical Examination on Admission.	Headache.	Mental Symptoms.
1. W. H., 30, m..	M.	Irish.	Carpenter	May 24. June 30, 1884. Died.	Compound fracture of skull.	Shortly before admission was struck on top of head by a brick. Ten days later began to have constant pain in head, neck, and back, with slight purulent discharge from wound.	Compound depressed fracture skull over right parietal lobe. Depressed fragment size of dollar was removed. Mental condition and sensation normal. No paralysis.	Moderately severe and constant, not localized.	Apathy developed late.
2. W. H., 29, m..	M.	U. S.	Janitor.	Oct. 24. Nov. 10, 1886. Died.	Linear fracture of skull.	Shortly before admission fell down stairs, striking head. Vomited several times. Hemorrhage from right ear. Severe headache for few days following injury.	Slight contusion over right parietal region. Semi-comatose; no paralysis. Left pupil slightly dilated. Considerable vomiting. Pulse 64 and full.	Severe, following injury, not present as symptom of abscess.	Irrational at times; delirium marked later; coma in final stage.
3. E. W., 11, m..	S.	U. S.	School.	Nov. 17. Dec. 26, 1896. Died.	Compound fracture of skull.	One month ago fell, striking right frontal region on curb, causing scalp wound, subsequently infected. Health normal, except for loss of appetite. One week ago fainted in school. Soon vomiting, headache, photophobia and delirium continuing to admission.	Small infected scalp wound over right frontal region. Mental condition normal. Some general headache. Reflexes normal. Slight ptosis right eyelid.	Severe, general, but worse in frontal region until consciousness was lost.	Stupor and delirium alternating.
4. M. B., 18, m..	S.	U. S.	Clerk.	April 9. May 29, 1897. Died.	Otitis media double.	Double otitis media since two years of age. Discharge from left ear increased during 2 weeks before admission with severe frontal headache. Day before admission, severe chill and fever; no vomiting; somewhat stupid.	Discharge from left ear. Stupid, but can be aroused; neck rigid. Some induration over left mastoid. Breathing stertorous.	Frontal headache, early.	First clear, later stupid.
5. C. G., 27, m..	M.	U. S.	?	Aug. 17. Aug. 23, 1898. Died.	?	General malaise for 6 months; thought by friends to have had malaria. Suddenly, 4 days before admission, right hemiplegia with loss of consciousness. Two days later had partly regained consciousness.	Mental condition dull. Partial motor aphasia. Complete right hemiplegia.	Slight and early.	Moderate stupor from admission; later coma.
6. W. C., 53, m..	M.	U. S.	Letter-carrier.	Jan. 26. Feb. 17, 1900. Died.	Trauma.	Contusion of scalp at 12 years from falling brick, ultimately leaving only a small indurated area. Syphilis at eighteen. Eight months before admission, area sloughed, discharging pus and necrosed bone, leaving exposed bone with continuing purulent discharge. No improvement under iodides or repeated curettings.	Over vertex of skull is an area 2½ inches in diameter of bare, hard, yellowish bone, with uneven surface. Adjacent scalp undermined about one inch.	Absent.	Semi-stupor for the last 4 days.
7. M. F., 22, f..	S.	U. S.	Dressmaker.	April 3. May 4, 1901. Died.	Otitis media chronic.	Measles at three years. Slight purulent discharge from left ear during last year and a half. At times slight earache and deafness. Two days before admission carious tooth removed from upper jaw. Day before admission vomiting, delirium, at times stupor, profuse perspiration.	Purulent discharge from left ear. Stupor; answers questions incoherently. Head retracted; some tenderness and pain in posterior neck muscles. Pupils normal.	Slight early; later severe.	Delirium with alternating stupor, later passing into coma.

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Temperature.	Pulse. Respiration.	Convulsions. Paralysis.	Miscellaneous.	Course and Duration.	Operation.	Autopsy.
Normal for 10 days, then varied irregularly between 99° and 103.8°. Generally below 101°.	Pulse never below 68, varying between that and 90.	Clonic spasms left arm and forearm, then partial left hemiplegia 5 days after onset; gradually became complete.	Constipation marked. Restlessness moderate. Pain in back of neck slight and early.	Formative period 10 days. Symptoms progressive. Duration 27 days.	No operation except for removal of fragments as previously described under physical examination.	Abscess cavity, diameter one inch, behind fissure of Rolando, in right parietal region. Small sinuses to surface, no meningitis.
Normal for 12 days then gradually rose to 103.2° where it remained.	Pulse never above 66.	Partial left hemiplegia a late symptom.	Restless. Left side of body warmer than right. Both pupils widely dilated during last week.	Formative period 9 days. Symptoms grew rapidly worse. Duration 7 days.	Two days after admission incision revealed linear fracture in right temporal region. Fourteen days later opening in skull enlarged, revealing subdural abscess. Drainage-tube, irrigation.	
Varied between 102° and 104°.	Pulse 64 on admission; later very rapid.	Twitchings of left side of body developed late.	Restless at times. Considerable pain in back of neck.	Formative period 3 weeks. Steadily growing worse. Duration 16 days.	Two days after admission incision showed linear fracture in right frontal region. Just beneath fracture was a small abscess with necrotic walls. No irrigation; gauze drainage.	
On admission 105°, then about normal for 5 weeks; later higher and irregular.	Pulse 120 on admission, 60 to 70 with the normal temperature; then rose with temperature.		Some nausea and vomiting during last 2 weeks. Stiffness in back of neck. Double lateral nystagmus. Leucocytes, 14,000 early.	Gradual improvement for 4 weeks after operation, then steadily grew worse. Duration 9 weeks.	Day of admission trephined above and behind left mastoid; negative result. Left mastoid then explored and abscess found communicating with one in brain. Drainage-tube; no irrigation. Six weeks later old area explored; mastoid soft; some pus in abscess cavity of brain. Larger drainage-tube.	
Irregular, between normal and 101°. Last day 104.5° (pneumonia).	Pulse between 60 and 76. Rapid increase with temperature.	Complete right hemiplegia; paralysis of bladder and rectum.	No gastro-intestinal symptoms. Partial motor aphasia.	Acute onset with hemiplegia following 6 months of general malaise. Duration 10 days. Death from broncho-pneumonia.		Many spots of broncho-pneumonia in both lungs. Large abscess in left parietal lobe, limiting membrane thin and brownish. Slight meningitis over left hemisphere with pus in a few of the sulci.
Between 99° and 103°. During the last week not over 100°.	Pulse 52 to 72 before operation; 2 days later 42 to 60. Then gradually increased, becoming irregular.	During the last five days frequent severe, tonic convulsions.	Double lateral nystagmus with convulsions. Leucocytes last 2 days, 30,000 to 37,000 (pneumonia).	Impossible to state duration. After operation had repeated convulsions with fever and soon lobar-pneumonia.	Denuded bone chiselled through, revealing extradural abscess containing 1½ ounces of pus with several pieces of dead bone. Dura was thickened and pulsating. Gauze drainage; no irrigation. Breathing very poor during operation. Cultures showed staphylococcus albus.	
Between normal and 102°, until terminal acute symptoms, when as high as 104.5° and irregular.	Pulse between 69 and 80; in final stage rose rapidly.	General clonic convulsions during last 4 days with partial right hemiplegia.	Vomiting last 4 days. Amnesic aphasia. Retraction of head. Pain sensation lost over right half body. Right hemianopsia late. Patellar reflexes absent after second day. Leucocytes highest count, 18,000.	Acute onset with vomiting and stupor Some improvement after operation for 2 weeks, then more acute symptoms with hemiplegia and convulsions.	Left temporal bone trephined; abscess spontaneously ruptured in lower angle of wound. Small cavity cleaned with peroxide. Later, abscess cavity again explored, revealing some pus and necrotic tissue. Culture, staphylococcus aureus.	

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3 an injury, but no fracture, and in another a penetrating bullet wound. Chronic otitis media was responsible for only 3 of the 22 cases. One was secondary to disease of the frontal sinuses; another followed abscess of the lung, complicating phthisis; and in a third the only pathological condition found post-mortem was a congenital heart-lesion. In the remaining 4 cases no etiological factor could be found, although autopsies were held on all of them.

The noticeable fact in this list is the high proportion, $54\frac{5}{10}$ per cent., of abscesses caused by trauma, compared to the $13\frac{6}{10}$ per cent. due to otitis media. Authors are generally agreed that inflammation of the middle ear usually causes between thirty-five and forty-two per cent. of the cases of cerebral abscess, and injury about twenty-four per cent. We can only explain the more than reversal of these figures by the large accident service of the hospital.

Occasional causes of abscess of the brain are suppurative processes in any other of the sinuses or cavities of the skull, and, not infrequently, metastases from other organs, especially the lungs. In conditions of general septicæmia, abscess of the brain is rare. About one-sixth of all cases show no cause, but possibly it may be some forgotten injury. One should also bear in mind that chronic otitis media may exist, producing fatal results without perforation or destruction of the tympanic membrane, and this may at times account for some of the cases in which no causative factor is discovered. In our list 4, that is eighteen per cent., could not be explained.

Abscesses of the brain are usually single, excepting those of pyæmic origin, when, according to MacEwen, two-thirds are multiple. Under such conditions the abscesses may be very numerous, von Bergmann reporting one instance in which there were more than 150 foci of suppuration. Of cases due to otitis media thirteen per cent., and of those due to traumatism seven per cent., are multiple.

In this table three examples of multiple abscesses occurred, a proportion of $13\frac{6}{10}$ per cent., two being due to trauma, but none of them being of pyæmic origin. In one following a penetrating bullet wound, the right frontal lobe was honey-combed with small purulent collections. In another, secondary to abscess of the lung, there were three foci, one in each of the three lobes—occipital, left parietal, and frontal. In the third, two large collections of pus were present, one in each frontal lobe. The etiological factor in this case was a linear fracture of the skull.

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Suppuration is much more liable to occur in the white than in the gray matter of the brain. Following traumatism, the abscess usually forms beneath the part struck, the lobes most often involved being the frontal and parietal. Abscesses by *contre-coup* rarely occur, and our series contains no example of this type.

Purulent foci resulting from otitis media are usually in the tempero-sphenoidal lobe or cerebellum. Gowers states that suppuration is four times as common in the cerebrum as in the cerebellum. In the former location it may be from any cause, while in the latter it is almost exclusively from ear disease or distant causes. Probably the small number of otitis media cases in our list explains the absence of any cerebellar involvement. It should be borne in mind that acute otitis media rarely causes abscess, a large proportion of cerebral abscesses following neglected cases of ear disease. A discharge from the ear for many years without any more serious symptoms is no guarantee that an acute and fatal process may not develop at any time. Thus, in one of this series, No. 4 (new), there had been a double otitis media for sixteen years.

In addition to the causes enumerated above, namely, otitis media, traumatism, disease of some of the sinuses or cavities of the head, and suppuration in distant parts, an occasional focus is the breaking down of a tuberculous lesion. It may also follow the specific fevers and has been reported as a sequel of influenza. If the suppurative process in the brain develops rapidly, there will be no evidence of a limiting membrane, but when considerable time elapses there is a distinct capsule enclosing the diseased area. The period necessary for the formation of a membrane varies a great deal, and there may be no evidence of one in three weeks. Such an encapsulated abscess may remain dormant and cause no future trouble, but, on the contrary, it may rupture either onto the surface of the brain or into the ventricles, with urgent and fatal symptoms.

In cultures made from the purulent discharge, all the varieties of pyogenic organisms have been found at various times, the most common being the staphylococcus pyogenes aureus and the streptococcus pyogenes; in two cases the oidium albicans occurred. In this group, cultures were made in but two cases, showing the presence in one of staphylococcus aureus and in the other of staphylococcus albus.

Age.—Children under ten years seem comparatively exempt

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from this affection. Of 223 cases collected by Gowers, only 24 were in the first decade of life. It is exceedingly rare under five years of age, and this is the more remarkable since otitis media and traumatism are so common at this time.

Holt, in 1898, was able to collect from the literature of the subject but twenty-seven cases under five years, in addition to five of his own, making a total of thirty-two. Only one of our cases was in a child, this being an infant seven weeks old, in which the right parietal lobe was almost entirely occupied by an abscess. The relative frequency in this series of cerebral abscess in the different decades is shown in the following table:

Age, to 10 years	1 case	Age, 30–39 years	4 cases
" 10–19 "	4 cases	" 40–49 "	1 case
" 20–29 "	7 "	" 50–59 "	2 cases
Age, doubtful	3 cases		

Sex.—Males seem to be much more liable to abscess of the brain than females. Gowers gives the proportion of three to one, and in our report about the same ratio holds, there being seventeen males and five females. This unequal distribution in the sexes is probably accounted for by females being less exposed to traumatism.

SYMPTOMS.

One or more foci of suppuration may exist in the brain for years without causing any disturbance. Von Bergmann cites the case of a twenty-year-old man, who as a child had a severe otitis media, but no further symptoms, and who died of pneumonia. The post-mortem examination showed five abscesses in the white substance, surrounded by a thick membrane. Of seventeen cases reported by Martius, the presence of cerebral abscess had not been suspected in one instance. At the onset the symptoms often depend upon the cause, and, if from chronic otitis media, there may be a decrease or even a cessation of the discharge, with, at the same time, beginning pain in the ear. Following traumatism, after a longer or shorter interval, the symptoms are often attributable to the injury.

If the term " latent period " is to be used in connection with abscess of the brain, it would seem to be applicable only to those chronic cases in which, during a considerable time (it may be years) there are no symptoms referable to the collection of pus. The symptoms

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may best be considered under the divisions, general and local. As being the more important, we will first discuss the general symptoms of brain abscess.

Headache.—This is usually prominent and may be continuous or intermittent. When the abscess is due to otitis media, pain is usually first experienced in the ear and soon extends into the temporal region. Later it often radiates to the frontal and occipital areas, still being more prominent in the temporal lobe. MacEwen points out that shooting pains may be present, darting through the brain from ear to ear, but this is more common in sinus thrombosis. When traumatism is the exciting cause of the abscess, the headache seems to be less often localized. In this series of cases headache was noted as present and generally severe in fourteen. In only one instance is there any mention of the pain being localized. It was then in the frontal lobe, and the autopsy showed the abscess to be secondary to disease of the frontal sinuses. In seven cases no mention was made of headache. This is usually an early symptom of abscess of the brain, and becomes less marked as the mental condition becomes more stupid. Of the fourteen cases in which headache occurred it was the first symptom in eleven, and was nearly always accompanied by feelings of languor and general malaise. In three instances there was persistent vomiting with the headache. Pain and tenderness in the back of the neck were noted in four of the twenty-two, and autopsy showed meningitis at the base of the brain in two of them, and the absence of any meningeal involvement in another. No post-mortem examination was held on the fourth.

Mental Symptoms.—Headache is almost invariably accompanied by some other form of mental disturbance; as, irritability, dulness with slowness of thought, loss of memory, stupor, coma, and occasionally delirium. Apathy, which is an early symptom, was noted in this group but four times. Stupor was observed in fifteen cases, generally preceding and passing on into coma; the latter being mentioned in ten instances. Delirium was a symptom in seven cases, varying from slight irrationality to violent delirium.

Temperature.—During the latent period, before any acute onset, the temperature is generally about normal, often even subnormal. This is typical of uncomplicated cerebral abscess, and is a very important point in differentiating between this condition and phlebitis, sinus thrombosis, and most meningeal cases. There may be large

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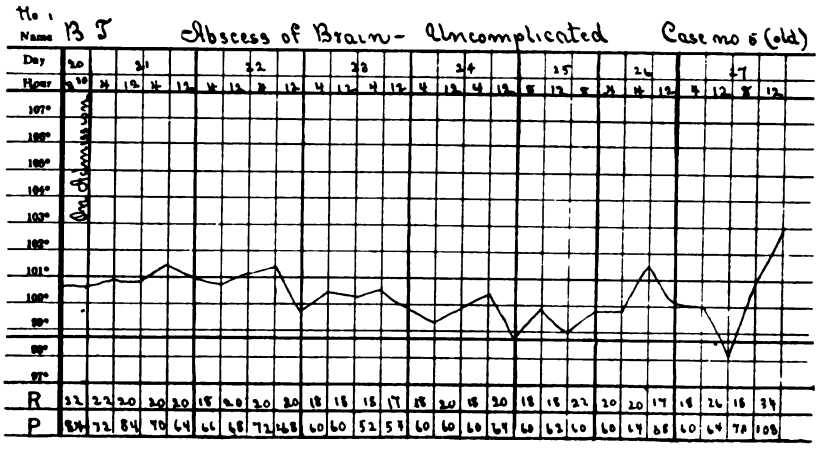

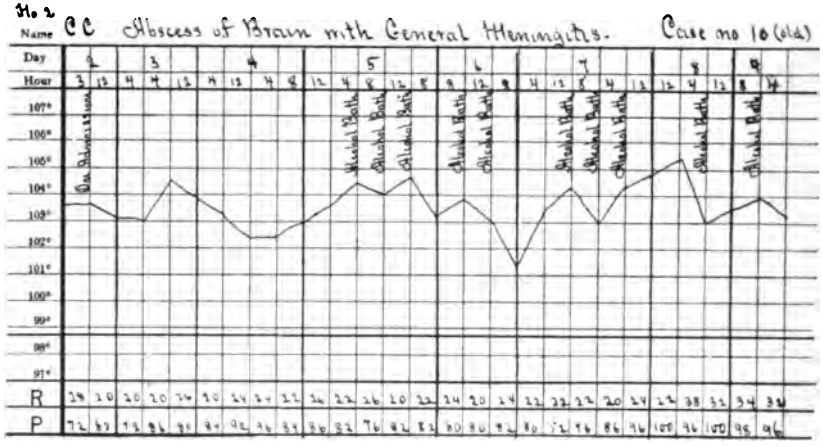

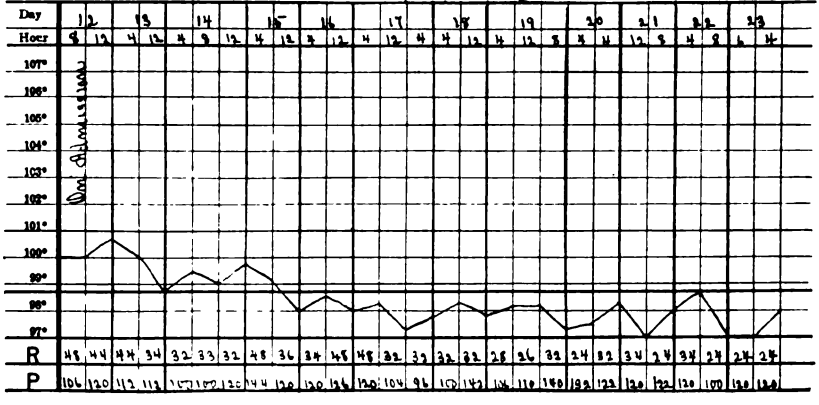

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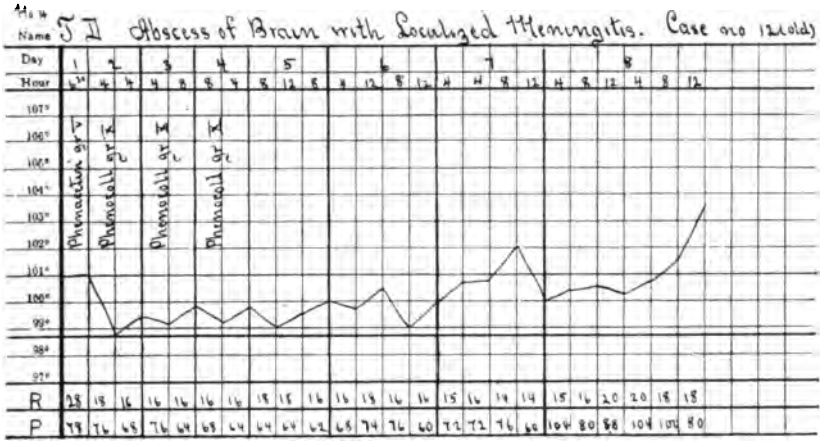

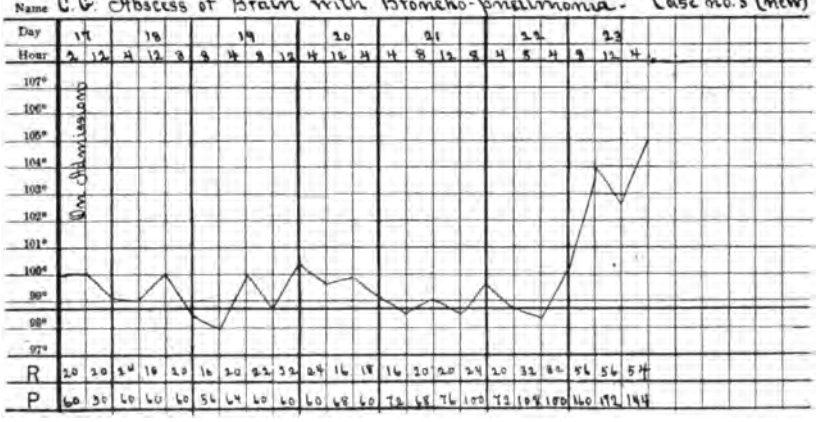

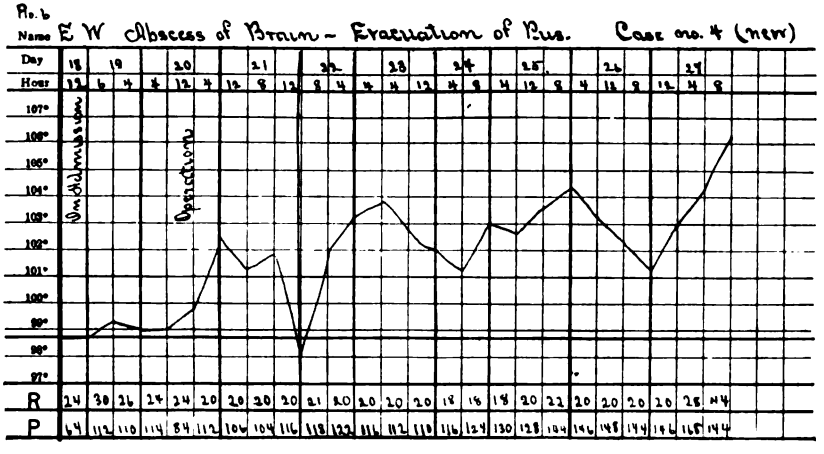

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collections of pus in the brain, and the temperature still remain normal. A short time before death, there is a rise in temperature to about 104° F. In cases of acute brain abscess there is usually high fever at first, later falling to subnormal when the inflammatory symptoms have subsided. After evacuation of the abscess cavity, the temperature rises quickly two to three degrees, and then gradually falls to normal in cases which are going on to recovery. Any complication will usually show in the temperature. The accompanying charts, all but one of which are from cases which came to autopsy, illustrate most of these points.

Chart I. is that of a simple uncomplicated case of brain abscess. Although the disease was very acute, proving fatal in two weeks, there was but slight elevation of temperature. Charts II., III., and IV. illustrate cerebral abscess complicated by meningitis; No. II. being from an adult with a marked general meningitis; No. III. from an infant with beginning general meningitis; and No. IV. from an adult with localized meningeal involvement at the base. Chart V. is from a case in which for a long time there must have been a collection of pus in the brain; yet the temperature remained normal until broncho-pneumonia set in and proved fatal. Chart VI. illustrates the usual rise of temperature after evacuation of pus.

Pulse and Respiration.—With the low temperature of the initial period there is usually a slow pulse, about fifty to sixty to the minute, but it may be as low as thirty. This is a common feature of several cerebral affections, as tumor, abscess, and encephalitis, and may also be due to pressure from fracture and clots. A marked acceleration of pulse occurs as soon as the abscess cavity is evacuated. In the terminal stage the pulse-rate increases with the temperature.

There is nothing characteristic in the respirations; they may be Cheyne-Stokes in type, and are usually slow.

Prostration.—During the development of the abscess in the so-called latent period, when there are no definite or characteristic symptoms, there is often marked prostration, later passing into stupor. Such a history, especially with a previous otitis media or an injury, should make one be on his watch for abscess of the brain. The history of Case 5 (new), obtained from friends, was that the patient had felt out of sorts for six months, and was considered to have malaria. No causative factor could be found at autopsy.

Disturbance of Digestive System.—Vomiting, often without nau-

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sea or relation to taking of food, is quite frequently met with, and is an early symptom. It was noted in only 6 of our 22 cases, which is a smaller proportion than is usually given. Rather obstinate constipation was present in 5. There is often difficulty in deglutition, and the nutrition of the patient rapidly suffers.

Chills.—MacEwen says a chill is one of the most common of early symptoms, and may vary from a mere chilly sensation to a violent rigor. Repeated chills rarely occur, and are usually indicative of sinus thrombosis or of some other infection. In only three of this group was there a severe chill, and in these it ushered in the terminal stage. In a fourth, chilly sensations were noticed early. Of the three cases, one was due to traumatism, a second to otitis media, and in a third no cause was discovered. Since the number in this series accompanied by a rigor is small, the idea suggests itself that this fact may be due to the small proportion of ear cases.

Leucocytosis.—In only two instances is mention made of a blood examination. In one, in which there was a complicating pneumonia, the leucocytes varied between 30,000 and 37,000. In the other, evidently uncomplicated, the highest count was 18,000. It would seem that during the inflammatory stage of the abscess, the presence of a leucocytosis would help differentiate from brain tumor. Unfortunately, meningitis and sinus thrombosis both give an increase in the leucocyte count.

Localizing Symptoms.—As previously stated, cerebral abscess due to otitis media is most often located in the temporo-sphenoidal lobe, the cerebellum being next in frequency. A small or medium-sized abscess in the temporal lobe usually causes no localizing symptoms, excepting that the pain at the onset is on the same side as the abscess. When in the left half of the brain, sensory aphasia may develop. With a larger collection of pus, adjacent brain tissue is pressed upon, and some paralysis results.

Paralysis.—Of the three cases due to ear disease there was no paralysis in two, while in the third, No. 7 (new), there developed, four days before death, paralysis of the right side of the face and partial loss of power in the right arm and leg, the abscess being on the left side. With a collection of pus in the cerebellum there are also but few localizing symptoms.

Suppuration due to traumatism is usually in the frontal or parietal lobes, and, as would be expected, the motor area is more fre-

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quently involved. Of the twelve traumatic cases there was marked paralysis in seven, with hemiplegia the most frequent type, and in four of these the paralytic symptoms were the first ones noted. In one case, in which the patient had had phthisis for several months, left hemiplegia developed during sleep; the autopsy showing three abscesses in the brain. In another, with no previous symptoms excepting that the patient had not felt as well as usual for six months, there was a sudden attack of right hemiplegia.

In six cases the sphincters were relaxed, and retention of urine was present in one. Motor aphasia was a symptom in three instances, sensory aphasia in two.

Convulsions.—The paralysis is often preceded by irritative symptoms, as twitchings or spasms. General convulsions are not common with abscess of the brain in adults. They occurred in four of our twenty-two cases—three in adults, and the fourth in an infant. In one of the three, No. 15 (old), the first symptom was a severe general convulsion. Four days later there was a chill and repeated convulsions, the patient dying the same day; the etiological factor could not be discovered at autopsy. In the two other cases in adults the convulsions developed late, while in the fourth, a seven-weeks-old infant, they ushered in the disease.

Of the thirty-two instances in children collected and reported by Holt, the symptoms were ushered in by a convulsion in seven, and convulsions were present at some period of the affection in twenty. Eight other cases in our series showed spasms and twitchings of greater or lesser extent. It is interesting to note that of the eleven cases in which there were muscular twitchings, eight were of traumatic origin; one was from chronic otitis media, one from abscess of the lung, and the last of unknown cause.

Sensation.—There seems to be nothing characteristic in the sensations. In two they were diminished on the side of the lesion, in one lost, in one increased on the opposite side, and in four normal. In the remaining fourteen no mention is made of any change.

Ocular Symptoms.—It is regretted that there was examination of the fundus oculi in only two cases, Nos. 1 and 9 (old). In these only slight congestion was found. Such an examination may reveal during the latent or at the onset of the acute stage an optic neuritis, which excludes a mere vascular lesion and a commencing meningitis. We cannot do better than quote from Gowers: "With no

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ascertainable cause and an absolute latency, an abscess can be suspected only by ophthalmoscopic examination. There is no other cerebral lesion in which the patient may plunge in a few hours from apparent health into imminent danger, and in which considerable neuritis is found at onset of acute symptoms, when there is no general disease to which neuritis can be due."

Pupillary phenomena are not uncommon. On the affected side the pupil may be contracted and sluggish and may respond slowly to light and accommodation. Such changes are especially liable to occur with an abscess of the frontal lobe.

Reflexes.—The condition of the reflexes was noted in but few instances, and seems subject to considerable variation. In one case, No. 7 (new), both patellar reflexes were absent from the second day after admission, excepting for a short time after operation with evacuation of the pus, when they were present.

Percussion.—MacEwen lays stress upon the change in the percussion-note over an abscess, but no attempt was made to obtain this sign.

It is evident that there is nothing characteristic of brain abscess in any individual symptom. The most common early manifestations are headache (which is very intractable), prostration, vomiting, slow pulse, and perhaps at first a slight elevation of temperature, often falling soon to subnormal. Moreover, the problem may be made more complicated by an accompanying meningitis.

Of the twenty-two cases, autopsies were held on seventeen, and in eight of these there was more or less meningeal involvement, thrombosis of the lateral sinus occurring in an additional one. There was an accompanying meningitis in five of the eighteen cases of abscess of the brain reported by Pitt from Guy's Hospital records, and in all it was secondary to the abscess.

Duration.—Acute abscess, if unmolested, generally terminates fatally in from one to four weeks, the patient becoming progressively weaker and soon passing into coma. However, at any time, an abscess may rupture either onto the surface of the brain or into one of the ventricles, and symptoms of the greatest severity develop. A chronic abscess which has been dormant for years may, without warning, take on an acute character. In such cases death usually results in a few days, unless operation is undertaken. In fourteen cases the symptoms ran an acute course, varying between three

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days and six weeks, nearly one-half of them proving fatal in two weeks from the onset. Eight of these were of traumatic origin. The remainder of the cases ran a more chronic course, at times extending over several months; four of them terminating with rapidly acute symptoms. Traumatism and chronic otitis media were causative factors in an equal number of these chronic cases.

DIAGNOSIS.

Diagnosis is a difficult problem in the adult, and often it can only be made within the limits of probability. It is impossible to reach a conclusion when the patient is first seen in the final stage with rapidly progressive symptoms. No. 15 (old) was admitted to the hospital, with no history obtainable, in a condition of profound coma, and died a few hours later. In children, still more uncertainty exists, for subjective symptoms are unreliable, and some of the ordinary signs are often lacking. In one instance of cerebral abscess appearing in a child, the case was considered one of tuberculous meningitis. The presence of a causative factor is of importance, as is also a consideration of the age and sex, brain abscess being rare in children under five, and occurring three times more often in the male. The mode of onset and sequence of symptoms must be studied, headache, vomiting, and prostration in the adult, and convulsions in the child, being frequent initial symptoms. In seven or eight of this group an operable intracranial lesion, discovered at autopsy, was not suspected during life.

The general plan suggested by Gowers, to establish a diagnosis of abscess of the brain, is adopted in this discussion. The mode of procedure is as follows: First, exclude a general disease, and so prove the presence of an intracranial lesion; second, differentiate abscess of the brain from other cerebral lesions; and, third, locate the abscess.

EXCLUSION OF A GENERAL DISEASE.—There are several affections in which the chief symptoms may be identical with those of intracranial disease. The main distinguishing points are as follows: The headache of organic disease of the brain is usually constant and severe, and when such headache is associated with optic neuritis the diagnosis of abscess of the brain can almost surely be made. Vomiting, without nausea, may be marked with an intracranial affection.

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MacEwen mentions percussion of the head as an aid in diagnosis; a change in note being at times obtained in cerebral disease. The general diseases which must be excluded are acute fevers, anæmia, nephritis, chronic lead-poisoning, and the functional nervous diseases, neurasthenia and hysteria.

Acute Febrile Disease.—A study of the history, with a careful physical examination, will generally suffice to exclude this type. The relation of headache to rise of temperature is important, Gowers making this distinction: "That the headache of fever ceases when delirium comes on; that of brain disease persists." Case 5 (old) was thought for several days to have typhoid fever; headache, general malaise, and slight rise of temperature being the pronounced symptoms. No examination of the fundus or leucocyte count was noted. The temperature record of the case is appended, Chart I.

Anæmia.—Headache and gastric disturbance may be marked, but a blood examination will always serve to distinguish this condition.

Nephritis.—Headache, while often severe, is seldom as intractable, and delirium and vomiting are not as frequent as with an organic brain lesion. In nephritis, changes in the fundus are at times pathognomonic, while, in cerebral abscess, optic neuritis is frequently met with. The associated nephritic symptoms usually serve to make the differentiation.

Chronic Lead-poisoning.—Headache, stupor, and delirium are sometimes prominent, often occurring with a sudden onset. The diagnosis is reached by considering the history, occupation, and the presence of a line on the gums, with other evidences of chronic lead-poisoning.

Functional Nervous Diseases.—There is an absence of any cause for a cerebral lesion, and the individual is usually young and of the female sex. The general nervous make-up should be considered as well as the presence of other functional nervous symptoms. One should remember that it is possible for such cases to develop organic brain disease.

(1.) *Neurasthenia.*—Headache may be well marked and continuous, but is more often localized than in intracranial disease, while vomiting may be a prominent system.

(2.) *Hysteria.*—The diagnosis is less difficult than with the preceding, because of other hysterical manifestations present. A fre-

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quent change of symptoms is quite characteristic of hysteria. Vomiting may occur, and is usually unaccompanied by nausea, resembling in this respect organic brain disease.

DIFFERENTIATION OF ABSCESS OF THE BRAIN FROM OTHER INTRACRANIAL LESIONS.—Several types of cerebral disease, some running an acute, others a chronic course, present symptoms similar to those of cerebral abscess. The diseases from which abscess of the brain must be distinguished are: Cerebral hemorrhage, embolism, meningitis, sinus thrombosis, middle-ear or mastoid disease, tumors, and, rarely, epilepsy, aneurism, cerebral softening, general paralysis of the insane and disseminated sclerosis.

Cerebral Hemorrhage and Embolism.—The diagnosis between cerebral hemorrhage, which is taken as the example of this class, and abscess of the brain is at times difficult, for both may have an acute onset; the latter disease is, however, more often preceded by premonitory symptoms. When of traumatic origin, the course of the disease is more rapid with hemorrhage than with abscess. Hemiplegia, with loss of consciousness and at times associated convulsions, may occur in both conditions, while optic neuritis is present only in abscess. The record of the temperature is of no assistance, and leucocytosis may appear with both. In Case 3 (old), with no previous warning, the patient was suddenly seized during sleep with partial left hemiplegia, soon becoming complete; autopsy revealed three abscesses of the brain.

Meningitis.—Uncomplicated cerebral abscess may be fairly well differentiated from a simple case of meningitis or sinus thrombosis, but the combination of any two of the three makes accurate diagnosis impossible. An associated general meningitis especially masks the symptoms of abscess. In Case 10 (old), temperature Chart II., the symptom complex was that of meningitis, the temperature being higher than one would expect with a simple abscess of the brain. Some of the chief distinguishing points between the two follow: Although both may be caused by traumatism or ear disease, in meningitis the onset is more sudden and the course more rapid. Vomiting and constipation are symptoms common to both, while optic neuritis is more frequent in abscess. The mental states correspond with somewhat more delirium in meningitis, but more intractable headache in abscess. In meningitis the temperature is higher and the pulse more rapid, while stiffness and tenderness of

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the neck is a more common symptom. Cranial nerves are more often affected, and convulsions are more usual. Photophobia and hyperæsthesia may occur in meningitis, but the former is rare in abscess. The presence or absence of Kernig's sign may assist in making the distinction.

In children the diagnosis of abscess is impossible when there is a coexisting basilar meningitis. Meningitis in the young is a common disease, and it is from this that cerebral abscess must most often be distinguished. Our only case in infancy, No. 13 (old), was considered a tuberculous meningitis. In this disease the symptoms are more often subacute, a family or personal tuberculous history is present, and other signs of tuberculosis may be found.

In chronic meningitis, which may be of syphilitic origin, headache, delirium, and convulsions at times occur, and optic neuritis is less marked than with abscess. Vomiting is seldom encountered, and localizing symptoms less often appear.

Sinus Thrombosis.—Sinus thrombosis is often associated with abscess of the brain, for both may be due to ear disease, and in that case the symptoms of the thrombosis are generally more prominent than those of the abscess. A fairly sharp differentiation may be made between abscess and sinus thrombosis. The chief distinguishing features of the latter are that the onset is more rapid, and that there is usually a high septic temperature, repeated chills, and a rapid soft pulse. MacEwen states that, when ear disease is the cause, shooting pains through the head from side to side are more often met with in sinus thrombosis than in abscess. When the lateral sinus is involved, there is often a hard, cord-like swelling along the jugular vein in the neck, with marked venous stasis of the vessels of the scalp; when the cavernous sinus is affected, exophthalmos may appear. In Case 11 (old), the prominent symptoms were those referrible to disease of the lateral sinus.

Middle-Ear or Mastoid Disease.—Marked cerebral symptoms, such as headache, apathy, and stupor, associated at times with vomiting and rise of temperature, may be caused by otitis media. In abscesses, however, the symptoms are, as a rule, more profound and progressive, and optic neuritis often appears. Deafness and vertigo are usually due to ear disease, seldom to cerebral affections. In two instances in this report, an abscess of the brain was opened into during the exploration of the mastoid.

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Tumor.—In the adult, tumor must often be distinguished from chronic cerebral abscess, and tumors as a whole are considered in this discussion. The only etiological factor common to both is traumatism, but abscess is more often caused in this way, and symptoms appear earlier than with tumor. As a rule, tumor has a more rapid course, focal symptoms are more frequent, and cranial nerves are more often involved. Fever is absent with tumor, while with abscess there may be either a subnormal or normal temperature, or, at times, a mild degree of pyrexia. Optic neuritis appears with both, but is more common with tumor. A partial subsidence of symptoms, at any time, favors the diagnosis of tumor. Where the growth is malignant, tumors found elsewhere aid one in determining the nature of the disease. Cabot states that leucocytosis is frequently present during the inflammatory stage of an abscess, while an increased number of leucocytes is less often found in tumor. Some authors suggest lumbar puncture as an aid in diagnosis; pyogenic organisms in the fluid withdrawn being proof of the presence of either abscess or meningitis.

Epilepsy.—Both epilepsy and abscess often follow traumatism, and in both instances the onset may appear a long time after the reception of the injury. Those cases of abscess of the brain in which a convulsion is the initial symptom are the ones which epilepsy most resembles. In epilepsy the diagnosis is made upon the history, the general neurotic tendency, and the fact that the patient can be aroused from the coma which follows the convulsion.

Aneurism.—Aneurism is usually confined to adult life, while abscess occurs at all ages. In the former, headache is a variable symptom and optic neuritis seldom occurs. A bruit is rarely heard with intracranial aneurism, and then only with the internal carotid variety. The aneurism is usually small and situated at the base of the brain. Hemiplegia, with a sudden onset, may be the first symptom, and is caused by rupture of the aneurism.

Some authors mention also the necessity of distinguishing at times between abscess of the brain, and cerebral softening, general paralysis of the insane, or disseminated sclerosis.

LOCALIZATION OF THE ABSCESS.—There may be no local symptoms, and in this case one must be guided by the causative factor and the general symptoms present. When of traumatic origin, the situation of the abscess may generally be determined; in otitic cases,

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however, localization is at times impossible, the diagnosis being then made from the general cerebral symptoms. The lobes most often involved are the temporo-sphenoidal and the frontal, and the right side of the brain is more frequently the seat of a purulent collection than the left. The frontal, parietal, temporo-sphenoidal and occipital lobes are considered in regard to their localizing symptoms, for these were the only regions involved in this series. Cerebral abscess may involve portions of adjacent lobes or, occurring in but one lobe, may cause additional symptoms from pressure on neighboring cerebral tissue. The symptom complex is then a combination of signs, referred to the various areas, motor symptoms being the ones most frequently met with. The cases discussed are those in which the location of the abscess was verified by autopsy.

Frontal Lobe.—The cause is usually traumatism, more rarely nasal or frontal sinus disease, and the abscess is seldom of metastatic origin. There are no definite focal symptoms, but a change in disposition and irritability are often present early, and may constitute the only distinctive symptoms for this region. They were not noted in any of the cases involving the frontal lobe. In one, frontal headache was a prominent symptom, but this may be marked with brain abscess involving other areas, and cannot be considered focal for the frontal region. Paralysis of ocular muscles or changes in the pupil on the same side may appear.

If the third and ascending frontal convolutions are the seat of abscess, corresponding muscular spasm or, more often, hemiplegia occurs; the adjacent part of the motor area in the parietal lobe being generally also affected. Motor aphasia, noted in one of our cases of frontal-lobe disease, is a symptom when the base of the third and ascending frontal convolutions are involved.

Parietal Lobe.—The cause is usually traumatic. The distinct localizing symptoms are those referrible to the motor area, muscular irritability, convulsions, and paralysis being present as early symptoms, the groups of muscles first involved guiding the operator to the site of the abscess. With the outer surface of the lobe extensively diseased, hemianæsthesia may be present. Word blindness is a symptom when the lower posterior portion of the parietal lobe is implicated. Of the five parietal cases, three had early and well-developed hemiplegia, while two exhibited repeated convulsions. No instances of hemianæsthesia or word-blindness are recorded in our list.

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Temporo-Sphenoidal Lobe.—Abscess in this locality is usually secondary to ear disease; but traumatism, and less frequently metastases, may be etiological factors, trauma being the cause in this series in four out of the five cases. There often are no focal symptoms, especially with an abscess of small size, but in a considerable number some localizing signs are found. There may be word-deafness if the posterior portion of the first or second temporal convolution on the left side is the seat of disease. Paralysis or convulsions from pressure on the adjacent motor area, or paralysis of the third cranial nerve from pressure, may occur. In the five cases of temporo-sphenoidal abscess, sensory aphasia appeared in but a single instance, hemiplegia was observed twice, while paralysis of the third cranial nerve was not mentioned.

Occipital Lobe.—Abscesses in this region are generally of metastatic origin, and metastatic abscesses being usually multiple, other brain areas are often involved as well. Our only instance of an affection in the occipital lobe was in a case of multiple abscesses in which also the frontal and parietal lobes contained purulent foci. Hemianopsia is a distinct focal symptom of occipital disease, and its importance is increased if it is the first local sign. It was not recorded in this instance.

Cerebellar Abscess.—Although there are no examples of cerebellar abscess in this report, a few differential points are here recorded. The most frequent cause of abscess in the cerebellum is mastoid involvement, while middle-ear disease more often leads to cerebral abscess. With a small focus in one cerebellar hemisphere, localizing symptoms are often absent; with a large collection, or one occupying the middle lobe or peduncle, the symptoms may be fairly characteristic. Vomiting and vertigo are frequent and marked, vertigo occurring less often with cerebral disease. Paralysis and convulsions are rare in affections of the cerebellum, but optic neuritis may occur in both. A diagnosis often cannot be reached; associated basilar meningitis at times adding to the difficulty of the problem.

TREATMENT.

From the operative standpoint, MacEwen reports the best results, with 18 recoveries out of 19 cases; the series of 55, collected by Sajous, shows a mortality of forty per cent. Holt advises against

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surgical interference in children, except in the presence of very definite local symptoms, for infants bear brain operations badly. Of our 11 cases operated upon, Nos. 1 and 2 (new) and No. 8 (old) were treated prior to the last fifteen years, when cruder methods and more faulty technique were in vogue. Case 14 (old) was complicated by general suppurative meningitis, and in No. 7 (old) there were numerous small abscesses occupying the entire right frontal lobe, making treatment of no avail. Reference is made to those surgically treated in the discussion which follows :

Prophylaxis.—Even the most careful physician cannot at times prevent ear involvement in some cases of acute infectious disease. In every instance otitis media should be treated to a successful issue, even to the point of surgical interference, some advising extensive operation when the disease is intractable. Every wound of the head or scalp, with or without fracture, should receive strict aseptic treatment, three of our cases developing where this precaution was not sufficiently exercised. If the brain is exposed, any lacerated or torn tissue should be removed.

Anæsthetic.—In cerebral abscess, as in other inflammatory diseases of the brain, chloroform should usually be employed. In the cases surgically treated, chloroform was administered six, ether five times. The reason for the employment of ether in this large proportion is not stated. Whether any cardiac weakness present influenced the choice is impossible to say. No. 1 (new) died a few hours after operation, possibly succumbing to the effects of the ether administered. The time of operation should be as short as is consistent with careful treatment.

Exploration and Evacuation.—Where a positive diagnosis cannot be reached, but a strong possibility of abscess exists, an exploratory operation in the adult is generally considered a justifiable procedure. In traumatic cases the trephine opening should be over the site of injury, except where abscess by *contre-coup* is suspected. When secondary to middle-ear disease, the opening in the brain should be made either over one temporal sphenoidal lobe or the corresponding cerebellar hemisphere. Where neither trauma nor otitis media is the cause, the place for trephining must be decided for each individual case. The trephine opening should be enlarged to a size sufficient for satisfactory examination of the membranes and brain. Neglect to expose the latter sufficiently may

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result in the abscess being overlooked, may allow less perfect drainage, and is more likely to be followed by hernia cerebri. In one instance in this report, the opening just reached the upper limit of the abscess cavity, where more complete exposure would have given better subsequent drainage. There were two instances of hernia cerebri, the trephine opening being small in both cases. The dura should be studied for any evidence of a suppurative process beneath, and fluctuation may at times be noticed with a large superficial brain abscess.

Exploring instruments of various types are described by several authorities. In this series, needles of large calibre were employed; and in the cases verified by autopsy, pus was withdrawn whenever the needle had been introduced into the abscess cavity. Starr cites a case with subsequent autopsy, in which the purulent fluid was so thick and viscid that nothing was obtained with a large exploring needle. To prevent passing through the abscess the instrument used should be withdrawn frequently. The total depth of exploration may be several inches, and, if at first unsuccessful, the needle should be passed in various directions.

Having located the abscess, pus is evacuated through an opening made along the exploring instrument. The brain sloughs in the cavity, and on its wall should be thoroughly removed. MacEwen advises, if necessary, the excision of healthy intervening brain-tissue. In one instance, sloughs of some size with retained purulent discharge were found in the abscess cavity three weeks after the primary operation.

IRRIGATION AND DRAINAGE.—Irrigation should always be practised, and gives the best results where the necrotic tissue has been completely removed. Any mild antiseptic fluid may be used, physiological saline solution being suitable. Of the cases operated upon, irrigation was employed in but three, and it is probable that routine and thorough irrigation might have yielded better ultimate results.

In a few acute cases, upon evacuation of the abscess, the brain bulges immediately into the trephine opening, obliterating the cavity and making drainage impossible and unnecessary; none in this series was of this character. In all other cases a free opening should be employed in the brain, dura, and soft parts of the head, for drainage must be free if the process of granulation is to proceed rapidly. In at least two instances the superficial and deeper openings were

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not of a size sufficient to allow the cavity constantly to empty itself. One should use a rubber drainage-tube, never gauze, for the latter is insufficient. In 5 of our cases gauze was used, and at least 3 were not properly drained by this means.

ADDITIONAL STEPS.—The only time when exploration for a second abscess should be practised is when some localizing symptoms point to a collection in another region of the brain, or when some evidence is found, at operation, of additional suppuration in the vicinity. In this report there were three instances of multiple abscess out of a total number of seventeen, on which an autopsy was performed. In two of these more than two abscesses existed, so that a second exploration would have been insufficient to provide drainage for all the purulent collections. In the third, two abscesses were present, one in each frontal lobe, and only one was drained, no further search being made, for no localizing symptoms pointed to another purulent focus. Only two of the cases of multiple abscess came to operation, and their fatal termination was undoubtedly due to the presence of the additional areas of suppuration.

If disease of the mastoid cells is the cause of the abscess, authorities advise an incision over the mastoid, with a complete operation to eradicate the primary source of disease. Without this procedure reinfection might constantly occur from the original focus.

SUBSEQUENT TREATMENT.—Rest in bed for a period of not less than six weeks is imperative, and this time should not be shortened because of rapid improvement in the mental and general condition. Case 4 (new), after remaining four weeks in bed with constant improvement, became rapidly worse upon being allowed up and about. Fluid diet for three or four weeks, with gradual addition of small amounts of solid food, is advised. The bowels should be moved early, and subsequent daily free evacuations are desirable.

In very acute cases, if the suppurative area is thoroughly cleansed, some advise a sterile dressing, and, if no local or constitutional evidence of infection develop, leaving the dressing undisturbed for five or six days, when the wound may be found almost healed. In less acute cases dressings should be done often enough to prevent accumulation of discharge, but not so frequently as to disturb and irritate the patient, once or twice daily being usually sufficient. The tube is left in place for several days and is then removed daily for cleansing. It should not be discarded for from two to six weeks,

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or while discharge in any amount persists. Once in this series, possibly a too early removal of the drainage-tube, after gradual but steady improvement, caused a rapid return of symptoms.

CONCLUSION.

In conclusion we wish to add a few words in regard to the high mortality, looking for some explanation of it. Seven or eight cases were not diagnosed. Of those operated upon, three occurred prior to 1886, when technic was poor; general meningitis was present in one, and lateral sinus thrombosis in another; two cases had multiple abscesses, the additional purulent foci not being discovered; one died shortly after operation, apparently from the shock attendant upon ether anæsthesia; and another succumbed to hemorrhage a few hours after surgical intervention.

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VIII.

VOLVULUS FOLLOWING APPENDICITIS.

By Forbes Hawkes, M.D.

THE following case of partial volvulus of the small intestine occurring eight months after an operation for suppurative appendicitis with perforation presents several points of interest.

M. K., aged twenty-three; female. Was operated upon in the Roosevelt Hospital, May 23, 1900, for appendicitis. She had previously had a number of attacks of right-sided abdominal pain associated with vomiting and fever. In this attack she had marked abdominal pain referred to the right iliac fossa, vomiting, fever (102.2° F.), and rapid pulse (112), with diarrhœa. A mass had formed in the appendix region. There was considerable rigidity of the whole abdomen, urine negative. The appendix was found with a perforation one-half inch from its base, situated free in an abscess cavity, the adhesions in the neighborhood containing small purulent foci. The pelvis was full of pus. The appendix was removed, the stump ligated with catgut and cauterized, and the abscess cavity, as well as the pelvis, thoroughly washed out with hot sterile salt solution. Three strips of iodoform gauze were introduced for drainage—one was carried into the pelvis, one placed around the stump of the appendix, the other inserted between these two.

The patient made an excellent recovery. Two of the gauze drains were removed on the fourth day, the other on the sixth; after that the wound was packed lightly. Pulse-rate and temperature reached normal on the fifth day. The wound healed nicely. She was in the hospital twenty-one days.*

Following this operation the patient was in good general health, except for some irritability of the stomach and constipation; strong cathartics were found necessary to secure a movement.

On February 3, 1901 (about eight months after her operation),

* Extract from Roosevelt Hospital Histories. Kindness of Dr. R. F. Weir.

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she was suddenly seized with an attack of abdominal pain, vomiting, and constipation not relieved by cathartics and enemata. Six days later, the above symptoms persisting, she entered the Presbyterian Hospital, in the service of Dr. McCosh. Her history on admission shows the following :

The patient is well nourished ; temperature 99.2° F. ; pulse, 78, fair quality. The scar of the old appendicitis operation was seen well out toward anterior superior spine of ilium ; no evidence of hernia. To the inner side of this the right rectus muscle is markedly rigid—distinctly more so than the left; no mass can be felt, however. The whole abdomen is slightly distended and somewhat tender. A peristaltic wave cannot be clearly made out. Vaginal examination is negative. No evidence of hernia in the inguinal or femoral canals. The vomiting is green, resembling that seen in general septic peritonitis ; it has a heavy odor, though not distinctly fecal. Enemata return perfectly clear ; there is no blood in them. The patient looks sick, yet does not present the appearance of one suffering from absolute intestinal obstruction. She says her appendix trouble was an " abscess."

With the above data a probable diagnosis was made of intestinal obstruction from peritoneal bands or adhesions, and operation advised.

Under gas and ether an incision was made just to the right of the linea alba below the umbilicus. In the peritoneal cavity was found a considerable amount of bloody serum. The presenting coils of small intestines were moderately distended and slightly injected. The caput coli and large intestine were collapsed. A few old adhesions were found uniting the caput coli to the abdominal scar ; the stump of the appendix could not be recognized. No obstruction could be felt or seen in the neighborhood of the ileo-cœcal valve. Passing the hand upward toward the liver, stomach, and spleen, the operator could feel no adhesions anywhere. The coils of small intestine were then successively reviewed from the ileo-cœcal valve upward ; and at about the middle of the ileum (as well as could be judged from the position of its mesentery) a loop was found very much darker in color and more firm in consistence than the others, but not appreciably more distended. Its peritoneal surface was everywhere smooth and shiny, without traces of adhesions. It had apparently undergone a partial volvulus, but the exact amount of torsion was

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not clear ; its mesenteric vessels, though congested, did not seem to be thrombosed. On straightening out this loop, which involved about twelve to fourteen inches of intestine, its color was seen to gradually become lighter and the intestinal walls softer to the touch. It took some ten to fifteen minutes for the coil to regain approximately its normal color. There seemed to be no tendency on the part of the intestine at this point to return to its volvulated condition. The rest of the small intestine was carefully inspected. It seemed normal. Liver, gall-bladder, stomach-area, spleen, both kidney areas, uterus, tubes, ovaries, and pelvic pouch were all found to be normal. The general peritoneal cavity was thoroughly flushed out with hot normal salt solution, and the intestines replaced in the usual manner, as much of the salt solution being left in as the abdomen would hold. The wound was sewed up tightly except for a small sterile gauze " cigarette " with rubber tissue cuff at the upper angle. Time of operation, forty-five minutes.

The patient came out of the anæsthetic nicely. There was only slight vomiting following the operation. Gastric lavage was, however, performed with relief, and five grains of calomel were introduced through the tube ; forty-eight hours after the operation, there being no movement of the bowels, a plain enema was given. It was returned of brownish color, and contained flakes of fecal matter. Twenty-four hours later the bowels began moving of their own accord and a considerable amount of oil was found in the dejecta. Following this, there were from two to six movements a day without medicine or enemata. On the tenth day after the operation the movements began to be " formed." Later, an occasional enema or mild laxative was sufficient to secure a daily movement. The small drain was removed on the second day, and the wound healed nicely "*per primam.*" She was allowed up three weeks after the operation, and left the hospital one week later in good condition. She was instructed to rely on enemata and abdominal massage rather than on cathartics for evacuating the bowels.

She has remained well since then, a period now of eleven months, and has gained considerably in weight.

Culture obtained from the peritoneal fluid at the time of operation showed the presence of the colon bacillus.

Had the obstruction been a mechanical one from a peritoneal band or adhesion, or from a herniated loop in the neighborhood of

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the scar, its connection with the previous condition would have seemed clear. There was, however, no evidence of any adhesions, old or recent, to this volvulated loop, or to any of the intestines in its vicinity, nor was there any indication on the surface of the loop of pressure by any band or by the edge of a hernial opening, such as is often seen in strangulated or incarcerated hernia. The affected loop seemed to be about the middle of the ileum, and was found just above the umbilicus.

Was the volvulus caused in some way by the over-action of the intestines, brought on by the increasing doses of cathartic medicine which the patient was obliged to take? This seems not improbable.

The failure of the bowels to move following the calomel given by the stomach-tube after the operation was attributed to a temporary paralysis of the previously volvulated loop, and it was thought wise on this account not to urge the intestines to further action from above. Vomiting had ceased, and the patient looked well. The bowels, therefore, were allowed to move of their own accord; this they did on the fourth day, a considerable amount of oil that had been taken by mouth before her admission to the hospital coming away in the first movements. It has seemed to the writer that in cases of intestinal obstruction of this or similar nature, relieved by operation, the subsequent inaction of the bowels, unless due to sepsis, should be recognized as a natural resulting condition, and that no attempt should be made to bring about peristaltic action in such a temporarily paralyzed intestinal coil during these first few days.

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IX.

A PLASTIC OPERATION FOR CIRCUMFERENTIAL CICATRICIAL CONTRACTION OF THE ARM.

By E. Eliot, Jr., M.D.

W. C., aged thirty-two; admitted to the hospital, November, 1900. Three years ago, patient received a severe burn of the right shoulder, extending down the arm a slight distance beyond the elbow. Besides the region of the shoulder, the burn involved the adjacent anterior wall of the thorax and the back as far down as the spine of the scapula. The upper part of the axilla was also involved.

At the end of six months, cicatrization had taken place throughout the denuded area, with the exception of a circular segment involving the entire circumference of the arm at the junction of its upper and middle third, between two and three inches in breadth. Six months ago, after treatment by both Thiersch's and Reverdin's method of skin-grafting, extending over a period of two years, this area also healed.

(Since that time, the resulting cicatricial band has gradually undergone contraction, with a corresponding diminution in the circumference of the arm.)

Four weeks ago, patient had an attack of erysipelas in the right arm, which subsided in the course of a fortnight, leaving the arm, however, permanently swollen, a condition which, since his recovery, is increased by any attempt to work. The patient also complains of limitation of movement of both the elbow and shoulder joints, although this would not be sufficient to prevent his working, in case the swelling disappear.

The patient has been advised to submit to amputation, but desires to try any procedure, which might possibly restore the function of the arm.

On examination, the anterior and posterior walls of the thorax, the adjacent region of the shoulder and the arm, and upper portion

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of the flexor side of the forearm are the site of scar tissue. This is evidently thickest and most dense at a point on the arm about four inches below the apex of the acromion process, and at this point has produced a marked constriction of the extremity. Above the constriction and about the shoulder there is considerable atrophy, evidently due to disuse, while, below, the region of the elbow, forearm, and hand is the seat of diffuse swelling, which readily pits on pressure. The œdema, most marked about the elbow, is evidently due to the pressure of the constricting band on the axillary vein.

On measurement, there is an increase of one and one-half inches in the maximum circumference of the forearm, of one inch of the circumference of the arm four inches above the tip of the olecranon, and of three inches over the elbow-joint. The circumference of the arm in its narrowest portion around the constricting band in one and one-quarter inches less than the corresponding circumference of the opposite side.

Extension of the forearm is slightly limited by a cicatricial band on the anterior aspect of the elbow, and abduction at the shoulder is moderately restricted by cicatricial bands in the axilla.

Pulsation of the radial artery is normal, and no undue dilatation of the subcutaneous veins can be detected.

The patient's general condition is excellent.

Operation (Ether).—The cicatricial tissue, forming the constricting band in the upper part of the arm was removed, exposing the deep fascia and in some places the muscle-layer itself. Only that portion overlying the axillary vein and branches of the brachial plexus was not disturbed. This left a defect of between two and three inches in breadth, involving seven-eighths of the circumference of the arm.

A flap, one and one-third greater in area than the defect, was then marked out on the lateral aspect of the chest, its base of attachment being situated just to the outer side of the nipple, extending around the axilla to and slightly over the angle of the scapula. This flap, consisting of all the structures down to the muscle, was then dissected away from the chest-wall as far as its base of attachment, and was placed tangent to the anterior outer and posterior aspects of the arm, being sutured to the upper, lower, and posterior edges of the defect with medium-sized silk. After the checking of the hemorrhage, the surface from which the flap was raised was

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FIG. 1.—Before operation, showing œdema.

FIG. 2.—Before operation, showing œdema.

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covered with Thiersch's skin-grafts. A dressing consisting of sterilized compresses soaked in a four-per-cent. hot solution of boracic acid, was then applied to both the arm and the area of skin-grafts, the arm being held in close apposition to the side by the application of a stiff bandage around the forearm and lower thorax.

The patient reacted well, and suffered little pain. On the following day, the flap was found to be warm, although its surface temperature was greatly diminished directly after the operation. At the end of four days, union had taken place along the line of junction of the edges of the flap and defect, with the exception of several small spots of sloughing along its upper margin; and a dry dressing of sterilized gauze was substituted for the previous wet dressing.

Directly after the operation, the œdema below the point of constriction disappeared and did not return.

The reparative process was accompanied by a temperature varying between 101° and 102° F., gradually diminishing until, by the third week, it had reached normal.

About one-half of the skin-grafts "took," the intervening areas healing by granulation.

Second Operation (at the end of four weeks).—Owing to the unusual length of the flap, it was deemed unadvisable to completely divide its base of attachment. Under cocaine, accordingly, the lower half only was divided, without in any way disturbing the circulation of the flap proper. Ten days later, five weeks after the original operation, the upper remaining portion of the base was divided, and the edge of the flap stitched to the anterior edge of the defect. The vitality of the flap was not impaired, and its edge when completely severed from the chest-wall bled quite freely, indicating the establishment of a sufficient collateral circulation. At the end of ten days, union had taken place, and the patient was allowed the use of the arm. Some stiffness gradually disappeared, and the arm soon enjoyed the same range and strength of movement as before the operation, without, however, causing any œdema. Sensation in the flap, referred, after the original operation, to the side of the chest, was shortly after replaced by mere tingling sensations, and, after the division of the base of attachment, by numbness. Several months after, sensation was present, but was much diminished. Two months after the secondary operation, the granulating area had en-

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FIG. 3.—After operation.

FIG. 4.—After operation.

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tirely closed, and the patient returned to work, experiencing no difficulty in following his usual occupation.

At the time of his discharge from the hospital, the circumference of the arm over the flap was one-eighth of an inch less than that of the opposite side.

Operative interference for the relief of cicatricial contraction is most frequently practised in the face and fingers. This is due, naturally, to the fact that these parts are more exposed to burns (face), and to infection resulting in extensive necrosis of tissue (fingers), followed in either event by the development of cicatrices, which by their subsequent contraction bring about malposition of joints as well as deformities of the facial orifices and the corresponding mucous membranes. These defects are remedied by some form of plastic operation, in which the cicatricial tissue is removed, and the defect filled in with healthy subcutaneous tissue contributed by some adjacent portion of the body from which, owing to a natural redundancy, it may be spared. If no such tissue is to be obtained in the immediate environment, similar tissue obtained from some distant part should be placed in contact with the denuded area, and should be allowed to remain attached to its source of blood-supply until, union having taken place, the flap is thereby enabled to receive its blood-supply directly from the underlying vessels.

The transplantation of the flap is then rendered complete by the division of its point of attachment original.

Plastic operations, based on one or other of these principles, are rarely required in these portions of the extremities which intervene between the joints, as they do not interfere with the function of the part in any way, and are disagreeable only in the deformity which they produce, and in their tendency to break down and form ulcers on slight provocation, which heal with increasing difficulty as the patient grows older. In instances of this kind, the deformity can be palliated, and the tendency to necrosis be largely obviated, by treating the area, after removal of the cicatricial tissue, with Thiersch's skin-grafts, or by transplanting portions of skin *en masse*, minus the subcutaneous fat, by Krause's method. When, however, the cicatrix surrounds the entire circumference of the extremity and is of considerable depth, its subsequent contraction must eventually interfere with the venous return and, afterward, with the arterial sup-

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ply of the part in question. Under these circumstances treatment by Thiersch's skin-grafts does not yield satisfactory results, for that these are powerless to prevent the subsequent contraction is well demonstrated by the preceding case. Such contraction can, in fact, only be prevented by the use of some form of flap operation.

The selection of the proper operation is largely a selection of an appropriate flap. In case of defect in a finger or hand, the problem may be easily solved by placing the defective area under a flap consisting of skin and subcutaneous tissue which has been raised from the chest and which still remains attached by both extremities to the chest-wall. A similar method to supply a defect in the upper arm, however, would naturally be impossible. Our only resource is to place a pedunculated flap, taken from the adjacent part of the chest, in contact with the denuded surface of the defect. Three different procedures for accomplishing this purpose were taken into consideration in the treatment of the case under discussion :

(*a*) One flap with its base of attachment near the angle of the scapula, composed of tissue of the lateral wall of the axilla and thorax as far forward as the nipple.

(*b*) One flap consisting of similar structures as in (*a*), but with its base of attachment in front, just to the outer side of the nipple.

(*c*) Two flaps, each of half the length of the single flap as mentioned in (*a*) and (*b*), with their bases of attachment near the angle of the scapula and the nipple, respectively.

The advantage of the single flap over the double flap was thought to consist in the fact that a closer approximation of the surface of the flap to the denuded area could be obtained, and that union would be more likely to occur. On the other hand, the double flap possessed the marked advantage of diminishing the probability of sloughing. The final selection of the single-flap method was made because of the greater probability of its securing a more satisfactory union between the two opposed denuded areas, and because the risk of sloughing did not appear so formidable when it was taken into consideration that, by Krause's method, small portions of skin can be transplanted without the loss of the viability of the section so removed. Having reached this decision, should the flap remain attached to the thoracic wall anteriorly near the nipple or posteriorly near the angle of the scapula ?

The proper choice of the base of attachment of a flap must

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always be made after a consideration of its blood-supply, sloughing being the less likely the more bountiful the circulation. Consequently a flap should have the broadest and thickest possible base of attachment, qualifications which in the present instance could be equally well supplied in both situations. The anterior attachment seemed preferable, however, inasmuch as it would receive nutrition from the thoracic branches of the axillary as well as from the intercostal branches of the aorta; then, too, not infrequently, the axillary gives off a good-sized branch, which, running parallel to the lower border of the greater pectoral muscle, passes directly to the nipple, lying throughout its entire course in the subcutaneous fat. Such a branch would run directly into the base of the flap. On the other hand, a flap attached posteriorly would receive nutrition from the intercostal arteries and from the termination of the posterior scapular, evidently a blood-supply inferior to that which could be derived from the axilla. The course of the case seemed to justify the selection which was made, for within twelve hours after the operation the distal portion of the flap regained its normal surface temperature, and the subsequent healing was quickly and satisfactorily accomplished. The œdema of the extremity immediately subsided, and, after the healing process had taken place, the function of the arm was so restored that the patient could follow his occupation in a satisfactory manner.

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X.

WANDERING KIDNEY, AND THE RESULTS OF OPERATION.

By Clarence A. McWilliams, M.D.

ALTHOUGH the conditions known as movable and floating kidney were first recognized by Rayer, in 1841, it is only within the past ten years that the subject has been more completely brought to attention, by reason of the greater care employed in observing and diagnosing abdominal diseases. The general practitioner who sees the majority of these patients has been a little tardy in recognizing the possibility of the dependence of gastric and intestinal symptoms, reflex neuroses, etc., upon displacements of the abdominal viscera. It is due to the observations and deductions of the gynecologists and the specialists in abdominal surgery, that particular attention has been directed to an abnormal mobility of the kidney as a frequent contributing factor, if not the actual cause, of much ill-health among women. That these specialists have placed too much weight upon the importance of this condition may, perhaps, with justice be maintained; but the general practitioner who sees and treats these patients before and after operation must in the last analysis be the umpire as to the advisability or non-advisability of subjecting them to an operation. In many cases the general practitioner turns his patient over to the surgeon for operation, after he has failed in producing marked improvement by medical means. Hence the physician is the one to judge whether more is accomplished by surgical procedures than by medical means, by an impartial comparison of the conditions before and after operation; and in making this statement the admission is forced upon us that possibly the early enthusiasm with which some surgeons hailed the operation, and executed it, will not be found warranted, if we trace these patients some years after the operation. The status of the operation is as yet an undefined one.

The following article has been written in the light of the cases

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presenting themselves at the Presbyterian Hospital for treatment, and is a report upon all the patients operated on for this complaint, to the number of sixty-one. An endeavor has been made to get in communication with them all, and to examine as many as possible. Of the whole number, sixty-one, it has been possible to get news from forty-five. The first operation in the Hospital for movable kidney was done on May 7, 1888.

We define a movable kidney as a displaced, and not fixed kidney, whose movements are subperitoneal; and a floating kidney as one which moves intra-abdominally, being surrounded by peritoneum, forming a mesonephron. To both classes we assign the general name "wandering kidney," as it is not possible to diagnose between the two conditions without operation. It is not recorded as verified by operation that a floating kidney (*i.e.*, one with a mesonephron) existed in any of our cases.

Frequency.—Wandering kidney is very frequent, so that it is difficult to determine what is pathological and what is normal. Its frequency is variously estimated. Küster, of Berlin, found that 4.41 per cent. of the women, consulting him in his general surgical practice, had pathologically movable kidneys. Goelet and Edebohls, of New York, each found that twenty per cent. of the women coming to them for gynecological treatment had movable kidneys. Harris, of Chicago, examined 126 women, and found fifty-six per cent. had palpably movable kidneys. Beyer, of Philadelphia, gives fifteen per cent. of his patients as having movable kidneys. Glénard, from his experience as a physician at the Thermal Hospital, in Vichy, met with 537 cases in 4,215 patients examined, or a proportion of fourteen per cent. of all patients, males and females, and twenty-two per cent. of all the females.

Degrees of Mobility.—The kidney normally presents respiratory movements. The mildest degree of mobility is where half of the kidney is palpable on deep inspiration, after which it slips back again under the costal arch. A marked degree exists when the whole kidney is palpable beneath the costal arch where it remains after expiration. Between these conditions we have to judge whether movability is abnormal, or not, by the symptoms suffered. The most marked degree is where the kidney is found in distant parts of the abdomen, as in the right iliac fossa or in the pelvis, and when it can be pushed about the abdomen.

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MEANS OF FIXATION OF THE NORMAL KIDNEY.

1. *Mechanical.*—The kidney surrounded by its fatty capsule lies between two layers of the renal fascia which join together on the outer, inner, and upper sides of the kidney, while at the lower pole the two leaves are lost in the loose tissue of the iliac fossa, so that there is left a weak place below. It is believed by many that the fatty capsule must undergo absorption before the kidney can become dislocated, but this is not always true, because the kidney often is sufficiently movable within the intact fatty capsule itself to become displaced; while again in other cases the normal fatty capsule, together with the kidney as a whole, may become movable and dislocated. There is an additional strengthening of the supports of the kidney by a fine scaffolding of connective tissue stretching between the capsula propria and the renal fascia. This may readily break or stretch.

2. *Dynamical.*—Of the very greatest importance in holding the kidney in place is the intraperitoneal pressure. This applies equally well to the other abdominal viscera. Conditions which decrease this pressure undoubtedly assist in producing mobility of the kidney.

Sex.—Among the 61 cases of our series, only 2 occurred in men, while 59 were among women, or 96.7 per cent.

Marriage.—Excluding the 2 men, 38 patients, or 64.4 per cent. of the women, were married, while 21, or 35.6 per cent., were single. Of the 38 married women, only 22, or 37.2 per cent., of the whole 59 had borne children, the average number of children to each one being 2.7. Consequently, from this it is seen that excessive child-bearing has been no factor whatsoever in the production of wandering kidney in our cases. The greatest number to any woman was 6, one had had 5, two had had 4, eight had had 3, three had had 2 children.

Location.—

Right kidney movable in	53	cases,	or	86.8	per	cent.	
Left	"	"	"	4	"	6.6	"
Both kidneys	"	"	"	4	"	6.6	"

Age.—The average age of the patients was 33½ years; the youngest 17, the oldest 65.

Between the ages of	20	and	25	years	there	were	9	cases		
"	"	"	25	"	30	"	"	"	17	"
"	"	"	30	"	35	"	"	"	14	"
"	"	"	35	"	40	"	"	"	9	"
"	"	"	40	"	45	"	"	"	9	"

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ETIOLOGY.

I. Acquired.—

(*a*) Due to lowering of intra-abdominal pressure.

1. After extirpation of great tumors or ascitic collections. None in our series.

2. Numerous pregnancies—not found to be an element of etiology in our cases, as only 21 out of the 59 had had children, the average being only two children per person. The greatest number to any woman was six.

3. Excessive emaciation. This was found in only two cases.

4. Tight-lacing. No evidence in any of our cases at time of operation.

5. Prolapse of the uterus and vagina, with lacerations of the perineum, may possibly contribute to the reduction of intra-abdominal tension.

6. Retrodisplacements of the uterus by drawing on the ureters may possibly tend to dislocate a kidney.

These causes certainly are not of great importance in producing mobility.

(*b*) Spinal scoliosis may cause the kidney to be pushed down, owing to a decrease in the space normally occupied by it. No case illustrating this point in our series.

(*c*) Trauma. In only seven of our cases, or 11.4 per cent., was there a history of a trauma antedating the symptoms referable to the kidney. Two of these stated that while lifting a heavy weight something seemed to give way in the side. In the other five there was a direct fall upon the right side. If a trauma acts as a direct exciting cause for movable kidney, then it would follow that we should find it more frequently in men than in women, because the former are so much more exposed to injuries. This is not the case.

(*d*) The transitory hyperæmia of the kidney during menstruation has been suggested as a possible cause of loosening of the capsules.

II. Inherited or Congenital Causes.—Probably most cases rest on congenital causes, although this is hard to prove.

III. Unknown Etiology.—Fifty cases, or 81.9 per cent., belong under this head. Probably in most cases renal mobility is due to a combination of several causes, of which we are as yet very much in ignorance.

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Harris, of Chicago,* has made a set of interesting observations on 126 women, chosen at random, to determine what influence bodily build has on the production of movable kidneys. He maintains "that the essential cause lies in a peculiar and particular body form, characterized by a marked contraction of the lower end of the middle zone of the body, with a diminution in the capacity of this part of the body cavity. This middle zone is bounded above by a transverse plane passing through the body at the lower end of the sternum proper, not the xiphoid appendix, while the lower boundary is formed by a similar plane which cuts the lowermost points of the tenth ribs. That this diminution depresses the kidney so that the constricted outlet of the zone comes above the centre of the organ, and all acts such as coughing, straining, lifting, flexions of the body, etc., which tend to adduct the lower ribs, press on the upper pole of the kidney, and crowd it still farther downward; and it is the long-continued repetition, in a suitable body form, of these influences which collectively may be called internal traumata, that gradually produces a movable kidney. A distinctly movable kidney is never the immediate result of a single injury or external trauma."

SECONDARY CHANGES IN A DISLOCATED KIDNEY.

1. Paranephritic adhesions may bind it down in an abnormal situation, so that it cannot be replaced without an operation.

2. From kinking of ureter brought about by movements of kidney, there may be produced a hydronephrosis; and, *vice versa*, the weight of a hydronephrotic kidney may cause a dislocation of the kidney.

3. Twisting of the renal vessels may produce passive congestion of the kidney, resulting in considerable increase in its size, as well as tenderness. May this not also predispose to structural changes in the kidney, and be the starting-point of a nephritis?

SECONDARY CHANGES IN OTHER STRUCTURES PRODUCED BY A DISLOCATED KIDNEY.

1. May press on duodenum, producing stomach dilatation, also on intestines, producing mucous entero-colitis, etc.

2. May press on bile-ducts, producing obstructive jaundice.

* Journal of the American Medical Association, June 1, 1901.

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This happened in one of our cases, or there may be typical attacks of colic simulating gall-stones, due to gall-bladder distention. Weisker calls attention to the close connection of the ligamentum hepato-duodenale to the bile-duct which lies in its sharp border; and as that fold is directly continuous with the peritoneal capsule of the kidney, it is difficult to imagine any very great displacement of the kidney taking place without an interference with the duct.

3. Pressure on superior mesenteric vein may cause congestion in cæcum and appendix, producing symptoms resembling appendicitis. There were such nine cases in our list, in which the appendices were removed.

4. Pressure and disturbance in the abdominal sympathetic may produce a variety of reflex neuroses from side of stomach, intestines, heart, general nervous system, genital apparatus, etc.

5. May press on uterine adnexa and produce irritative and congestive disturbances. This is clearly shown in one of our cases. Operation relieved these entirely.

SYMPTOMS.

1. *Subjective Symptoms.*

Class 1. Those in whom the movable kidney causes no symptoms, and is discovered by the doctor in the course of routine examinations. Most of the cases belong under this category. To persons of hypochondriacal tendencies, knowledge of such a condition, revealed to them by a careless physician, may cause the beginning of complaints referred to that kidney.

Class 2. Cases with actual symptoms, which may be caused by the dislocated kidney, apart from other independent abnormalities.

(*a*) Pain. Some of the patients complain that after long standing, or unusual bodily exertion, painful sensations make their appearance, generally on the right side of the abdomen, either dull or sharp or dragging, localized over kidney, or radiating to back or chest, or very frequently down right thigh. Severe backache in 12 of our cases was complained of. Lying down commonly relieves this discomfort. In 24 of the cases the pain was localized distinctly in the right kidney region, and of a dull ailing character. In 10 of the cases the pain was sharp and renal in character, and shot down into the thigh. In 13 cases the pain was localized in the right side, and

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associated with severe backache. In 7 cases there were attacks similar to mild renal colic, the pain shooting down into the bladder, and in 4 others shooting into the back, while in 2 cases the sharp pains shot up into the right shoulder. Nine of the patients noticed movable masses in the abdomen, and 2 patients felt a movable tumor on each side of the abdomen. It is the pain which sends these patients to the physician, and it is almost constantly present in some form where movable kidney is at the bottom of the trouble. Usually, however, this pain is associated with various other symptoms which may lead the physician astray. The difficulty is to decide when the pain is due solely to the movable kidney, or when to coincident and independent causes. Sometimes lying on the left side, which allows the right movable kidney to fall over toward the left, will cause considerable pain. The pain in 7 of our cases was much worse during menstruation.

(*b*) Disturbances of gastro-intestinal tract are of very frequent occurrence. In 25 of our patients a history of distinct gastric indigestion was given, extending over a considerable period; 11 others gave a history of vomiting during the severest part of the attacks of pain; 28 gave a history of marked constipation; 9 gave evidences of a coincident appendicitis; 1 case had had attacks of jaundice; 3 gave a history of attacks of diarrhœa.

Bramwell* reports a case with autopsy which he says shows: "1. Recurrent intermittent spasm of the pylorus may proceed to such an extent as to lead to a mechanical stenosis, causing most aggravated form of gastric dilatation. 2. That such a pyloric stenosis may be the direct result of intermittent traction of a movable kidney. 3. That an acquired movable kidney does not move up and down in a space behind the peritoneum, but carries its peritoneal covering with it, stretching the inferior reflection of the peritoneum to some extent, and gliding over the angle of this reflection, while at the same time it stretches and drags upon its superior and internal reflections, drawing these into distinct bands which directly drag upon the pylorus; and the only true remedy for such a condition is to fix the kidney." Franks described a similar case of peritoneal band stretching from duodenum to a movable kidney.

(*c*) Urinary symptoms in our patients were not prominent; 18 gave some history of urinary trouble. Nine said that micturition

* British Medical Journal, October 19, 1901

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was simply increased in frequency, while in 4 others it was not only frequent but painful as well, 2 had simply occasional pain on micturition, 1 had attacks of incontinence, 2 others complained of increased frequency with occasional hematuria, while 5 said they passed an increased amount of urine at the end of the attack. One patient, from whose movable kidney at the time of operation a calculus was removed, had never had any urinary symptoms whatsoever. Her whole complaint was of the sharp right-sided pain. Two patients at the time of the operation had chronic nephritis. One had a suppurative pyelitis (No. 40).

(*d*) Many show symptoms of reflex neuroses of various kinds, nervousness, easily fatigued, headaches, depression, often insomnia, and cardiac palpitation; 11 of our cases were decidedly neurasthenic. Probably this number is not sufficiently large, as the presence or absence of this condition is not noted in the earlier histories.

(*e*) Some give a history of attacks like renal colic, due either to kinking of ureter, or to twisting of renal vessels. Some of our patients gave histories of attacks of fairly typical renal colic. These attacks are, as a rule, immediately relieved by replacing the kidney in its proper position.

Class 3. Those in whom symptoms of dislocated kidney are only a part of a general enteroptosis. Five such cases are contained in our list, but here again the histories are probably deficient. It is a great question whether nephropexy is indicated in this condition.

2. *Objective Symptoms.*

The women suffering from wandering kidney are very frequently found to belong to an almost characteristic type. They are usually very thin, lank, and with a long-built thorax, almost emaciated; have weak musculatures, abdominal walls are relaxed and flabby, are nervous, and often mentally depressed. To establish the diagnosis, one must find a more or less movable tumor in the abdomen which has the size, shape, and consistency of the kidney. It may not be evident on the first examination, but a second or even a third observation may reveal a very evident dislocation.

A careful method of examination should be pursued and various devices resorted to before giving a definite opinion. With the patient on her back, and thighs flexed on the abdomen, the exam-

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iner, being on her right, inspects carefully the abdomen to note its appearance, and the presence of any prominence anywhere. He then palpates the abdomen gently to note any unusual condition, and then places the flat of the left hand behind and just below the twelfth rib, exerting gentle pressure forward, so as to bring the kidney into prominence. The other hand is placed upon the abdomen in front, below the border of the ribs and external to the rectus muscle. The patient then takes a deep inspiration, followed by a quick expiration, when the examiner approximates the two hands, at which time one-half or two-thirds of the kidney, if it be movable, can be grasped, and at times can be made to slip upward from between the hands with a sudden jump, as it drops again into its hollow. If this does not elicit a movability of the kidney, the patient should take successive inspirations and expirations. At the end of each expiration, the front hand is crowded farther and farther in, and held stationary during the inspirations. The value of this procedure consists in the fact that the kidney, descending with the inspirations, cannot return into its niche, owing to the increasing bimanual narrowing of the opening into this hollow. In some cases the two hands will meet above the upper pole of the kidney, which may be well palpated, and the pulsations of the renal vessels felt. At times the dislocated kidney may become more apparent by having the patient sit up in bed and bend forward, or the kidney region may be palpated while the patient stands up. The knee-chest position may be utilized to cause the kidney to fall forward. In addition, the patient may lie on the left side, with the thighs flexed on the abdomen, in order to cause the kidney to fall internally and downward.

The presence or absence of normal kidney dulness, as elicited by percussion, is too uncertain to be of any differential diagnostic value.

Careful differential diagnoses must be made from diseases of other abdominal organs:

1. Distended Gall-bladder.—There is a difference in the fixed points of the gall bladder and the kidney, accounting for the difference in direction of movability, the bladder moving from side to side, while the kidney moves up and down. With the patient lying on the left side this will become clearer. The gall-bladder lies superficially and more anteriorly. The kidney is deep in posteriorly. The gall-

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bladder on successive examinations will be found each time to have a constant position, while a movable kidney may be found in very varying situations.

2. New Growths in the Abdomen, particularly Ascending Colon Tumors.—Both may lead to colicky paroxysms and nausea which cause errors in diagnosis. The movement of these tumors is limited mostly to a transverse direction, and they can be moved upward or downward to only a slight degree. Sometimes the patient gives a history of the appearance at times of a smooth, hard, ovoid body in the right abdomen, with colicky pains. This body may disappear, coincident with the subsidence of the symptoms. This is due to the periodic distention of the intestines, proximally situated to the tumor, and if the hand is quietly laid upon the abdomen till the pain subsides, one will feel and hear the gurgling of the gas as it passes the obstruction.

3. Cancers of the Pylorus.—These cause greater cachexia and severer stomach disturbances, while the tumors are situated higher and nearer the median line, and are not variable in their location at successive examinations.

4. Impacted Fæces.—This tumor disappears after the exhibition of purges and enemata.

5. Cyst of Pancreas.—This condition rarely occurs, and the tumor is not movable, nor variable in the location of its appearance.

6. Ovarian Tumors.—These ought to be differentiated by the history and a bimanual vaginal examination.

7. Other Kidney Affections, such as Tumors and Calculi.—Careful attention to the symptoms and examinations, particularly the urinary, will give in most cases clews to the diagnosis, while a ureteral catheterization will often clear up doubtful cases. In movable kidney, the symptoms generally subside on lying down, and replacement of the organ. If pain occurs at night and after reposition of the organ, then it is quite likely that some other kidney affection is present.

8. "Riedel's," or "Tight-laced," Lobe of Liver.—This abnormality has been the cause of error in diagnosis and subsequent ineffectual operation. This happened once in our series.

A careful examination should be made of all the abdominal organs to ascertain their condition and position. This applies especially to the liver, stomach dilatation, position and size of spleen,

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state of the appendix vermiformis, and particularly the condition and position of the pelvic organs. Many of these women have associated pelvic derangements, retrodisplacements of the uterus being common, with possible prolapse of the ovaries. Too much stress must not be placed upon the movable kidney as the cause of the symptoms, to the exclusion of the possible effects of the malpositions and inflammations in the pelvis. Proper measures should be taken to correct all the abnormal conditions in the abdomen if a good result is to be looked for. Herein lies the difficulty in treating these cases, because it is difficult to determine how many of the symptoms are due primarily to the movable kidney, hence suitable for nephropexy.

THERAPY.

The position of this Hospital has always been a conservative one as regards the treatment of wandering kidneys. In general, perhaps, there has been among surgeons too great an operative activity in this field, because: 1. Symptoms have been referred to the wandering kidney which have, in many cases, arisen from other sources, such as the neuropathic condition, disturbances arising from the genital apparatus, alimentary canal, etc. 2. The wandering kidney is in many cases only one part of a more or less general enteroptosis of the abdominal organs, in which condition nephropexy will do but very little good, if not harm. 3. There has been too great an optimism as regards the final good results of the operation in relieving symptoms. This is clearly shown in the reports of cases followed for some time after operation, in which it is quite evident that the results, so far as a cure of symptoms is concerned, are somewhat disappointing. Results will be quoted later.

Treatment resolves itself into: 1. Therapeutical. 2. Mechanical. 3. Operative.

Following Israel, it is our belief that the only absolute operative indication occurs in those cases having colicky attacks which are the result of pulling or kinking of the pedicle, particularly if these attacks are accompanied by temporary or lasting retention. In the remaining cases, non-operative methods first are to be employed, and these will in most cases relieve very considerably, if not cure. In the event of their failure, operation is to be advised.

In laying out a therapeutical line of treatment, the first requisite

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is to ascertain the exact condition of all the bodily organs, more particularly the nervous system, the gastro-intestinal functions, the genital apparatus, the position of the abdominal organs, etc.; after which means are applied to combat the abnormal conditions. The patients must be prevented from over-anxiety and worry as to their condition.

The general health and weight may be increased by the Weir-Mitchell rest-cure and forced feeding, which will also improve the nervous symptoms. Atony of the abdominal walls, displacement of the intestines, with deficient peristalsis and tendency to gas-formation, will be combated by massage, gymnastics, electricity and hydrotherapy, bandages and tonics. Long standing should be interdicted. Women whose symptoms, referrible to wandering kidneys, are worse at the menstrual periods should remain in bed some days before and during the period. General treatment should always be combined with mechanical treatment, which consists in the application of some kind of an abdominal supporter. A cushion alone in front to support the kidney had better not be employed, because it generally will not succeed in holding the kidney in place, and, secondly, its pressure on the kidney may be dangerous, causing albumin, casts, and red-blood cells to appear in the urine. Any arrangement to bring relief must provide for an equal increase in the whole intra-abdominal pressure, and must take the place of the lost tone of the relaxed abdominal wall, and raise up a hanging abdomen. An equable increase in the intra-abdominal pressure decreases the possible excursion of the kidney. An elastic corset to meet these indications is made as follows, and I take the description from Israel, of Berlin: The corset is made of material similar to an elastic stocking, and is woven to fit each patient. The median closure line is strengthened by a steel spring. The corset extends as high as an ordinary corset, and as low as will allow the sitting posture without discomfort. From corresponding portions of the corset, just above the symphysis, go to each side two broad elastic girdles which encircle the pelvis just above the inguinal folds and are fastened to two short pieces attached to the sacral region. These elastic girdles are intended to raise up the lower abdomen. A second pair of girdles runs around the flank, starting from the same place as the first pair, one on each side, obliquely upward and outward between the iliac crest and the ribs, and are fastened with

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hooks and eyes behind at the height of the middle lumbar vertebra. Through these obliquely upward-running girdles a particular elastic pressure is exercised upon the entire territory into which the kidney can sink. This pressure, if thought best, can be increased through a three-cornered air-cushion fastened to the inner side of the corset in this manner—the upper slightly concave edge lies just below the costal arch. Its rounded point fills the interval between this and the iliac crest, while its median base reaches to the mammillary line. Over this cushion runs the upper girdle, and presses dorsally and upward the covered part of the abdomen. This supporter is put on before arising in the morning.

A less expensive procedure is that devised by Gallant, who has the patient obtain one of the at present fashionable straight-front corsets, two sizes smaller than usual. The patient is advised not to get up in the morning until she has applied the corset, which is put on with the pelvis elevated, the kidney having been replaced in its proper position. The corset is hooked from below up, at the same time crowding all the abdomen upward within the corset as it is hooked.

Persons with movable kidney may be the victims of attacks apparently very similar to renal colic, so called Dietl's crises. Examination may show a dislocated kidney, tender and largely increased in size. These attacks may last for hours or for days, to end suddenly on the return of the kidney to its normal position. This is often followed by the passage of an increased amount of urine, which may previously have been scanty. This condition is due either to kinking of the ureter, or twisting of the renal vessels, or, perhaps, more often, to a torsion of the whole pedicle at once, vessels and ureter together. The palliative treatment of these attacks is to replace the kidney, and to undo the twist of the pedicle. To accomplish this latter, the mechanism of its origin must be understood. The wandering kidney turns about its transverse axis, in such a way that the lower pole of the descending kidney finally impinges upon the anterior abdominal wall, and this prevents its farther descent. If the upper pole still farther descends without change in position of the lower pole, then the upper pole must come to a lower level than the lower one, *i.e.*, twisting of the kidney about its transverse axis, the pedicle acting as this axis, which will only be increased by any muscular contraction of the abdominal walls. To arrive at this abnor-

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mal position, in which the lower pole is turned forward and upward, the upper pole behind and below, the arc of rotation has been from 80 to 180 degrees, which is amply sufficient to cause severe circulatory disturbances in the relatively short pedicle. If this view of the etiology is correct, then treatment (with the patient recumbent and hips elevated) consists in grasping the kidney tumor in front and behind with the hands, and in seeking to give it such a turning that the lower pole, which has become temporarily the upper and forward one, will descend along the inner side of the anterior abdominal wall while the upper one, temporarily the lower, will ascend along the front surface of the posterior abdominal wall, to return to its hollow beneath the diaphragm. This procedure is eminently rational in the suitable cases. Should, however, as some maintain, the twisting of the pedicle take place in the opposite direction, then a reversed method of treatment is necessary.* If these procedures do not replace the kidney, then the recumbent position should be maintained till the attack is over. In case the attack grows worse from day to day, then operation, nephropexy, is indicated. Should this be refused by the patient, then the fluid in the sack may be drawn off retroperitoneally by an aspirating syringe, in the hope that relief from pressure may result in relief of obstruction.

Operative Procedures.—If after thorough trial of therapeutical and supporting measures, the symptoms referrible to the kidney still persist, then our only recourse is to operate, but the patient must be cautioned against expecting too much from the nephrorrhaphy, and a guarded prognosis given to avoid future disappointment.

Technique.—Two varieties of nephropexy have been employed, depending upon the operator. One method is as follows: A longitudinal lumbar incision is made with the patient in the semi-prone position, an air-cushion being placed beneath the opposite ilio-costal space, which makes the ilio-costal region on the side to be operated upon as broad as possible. The incision extends from the lower rib to the iliac crest, the lumbar artery encountered is cut between clamps, and the nerve with it is pushed to one side and not cut. This exposes the outer border of the quadratus-lumborum muscle.

* Owing to the difficulty of correct diagnosis as to the direction of this revolution, care must be exercised in these manipulations lest the twist of the pedicle be increased instead of decreased.

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A deep retractor holds the outer edge of this muscle internally. The fatty capsule surrounding the kidney now presents in the wound, and it is opened longitudinally, and the kidney located within this fatty capsule, which is then stripped off from the anterior and posterior surfaces of the kidney. With an assistant exerting pressure on the anterior abdomen against the kidney, an endeavor is then made to bring the kidney out into the wound, so that it may be inspected and palpated thoroughly for any other existing pathological condition, either in its pelvis or parenchyma. The fibrous capsule lying close to the kidney is incised, either along the convex outer border, or on the posterior surface of the kidney, and the edges of the capsule on either side of the incision are dissected off from the kidney, making two small strips of capsule between which is raw kidney tissue. Three chromicised gut sutures on a carpet-needle (to prevent oozing) are then passed directly through kidney parenchyma beyond the raw area, *i.e.*, from anterior to posterior surfaces, well within the convex border, at intervals of about an inch. The highest of these sutures is often passed around the lowest rib at a point where the periosteum has been reflected from its surface. This prevents opening of the pleura. The other chromic gut sutures are then passed through the lumbar fascia and the quadratus-lumborum muscle, but not tied. The small strips of fibrous capsules are then sutured by a few chromic gut sutures to the fascia and muscle on each side of the lumbar incision, leaving the raw place between these strips. Then, finally, the parenchyma sutures are tied, and the kidney is held well up under the last rib. A narrow gauze strip surrounded by a cuff of rubber tissue is inserted down to the kidney. This is important for two reasons: 1. It acts as a drain. Should a blood-clot form between kidney and muscle, then the kidney would be separated from the muscle, which might prevent proper union, a result very desirable to obtain. 2. The drain acts as an irritant and thus favors the formation of connective-tissue adhesions between the kidney and the muscles. The incision is then sutured carefully in layers in order to prevent lumbar hernia, a result which has more than once occurred. This method has been mainly employed by Dr. McCosh. Transfixion of the kidney by the sutures has found many advocates, among whom are Israel, of Berlin; Kocher, Tillmann, Stimson, etc. The objections advanced by its opponents have been: the possible danger of infecting the kidney tissue, and the damage

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done to the parenchyma itself by the presence of the sutures, possibly resulting at times in pulmonary emboli and chronic changes.

In addition to the parenchymatous sutures, Dr. McCosh, according to the suggestion of Dr. Morris, for the past year has been reflecting a large-sized strip of the fibrous capsule from the posterior kidney surface, leaving it attached at the convex border. This strip is then inserted into a split made in the quadratus lumborum muscle, and there sutured with chromic catgut sutures. Then the parenchymatous sutures are passed and tied. A gauze drain is inserted down to the kidney. Dr. McBurney, Dr. Briddon, and Dr. Eliot have used the following method: Same vertical incision as above, and kidney exposed and drawn out into wound. Fibrous capsule is split on its posterior surface, and two flaps of about the size of a fifty-cent piece raised up from the kidney substance. Each one of these flaps is then sutured to the deep edge of the lumbar incision with interrupted chromic gut sutures, which take in their grasp some portion of the muscles. A gauze drain is inserted down to the raw area of the kidney, followed by a careful closure of remainder of wound, so as to prevent the development of a subsequent hernia. No parenchymatous sutures are used.

After-treatment.—The patient should remain flat on her back without turning for three weeks. During this time she should make no muscular exertion whatsoever, as this might tend to disturb the adherence of the kidney to the lumbar wall. The gauze drain in the wound may be withdrawn little by little at each dressing, beginning about the fourth day, till the gauze is completely removed by the tenth day, or may be removed entirely at the end of twenty-four or thirty-six hours. The patient should be kept in bed for at least four weeks. After leaving her bed, she for six months should be cautioned against muscular labor involving lifting, etc., and it is possibly best to have the patient wear an abdominal supporter to keep the abdominal viscera in place.

Nephrectomy is to be done only in very exceptional cases, chiefly when the organ is diseased as well as movable. Extirpation has been done most frequently for hydronephrosis in a movable kidney. One must always be sure, before extirpating a kidney, that the opposite kidney is in a sound condition. Two cases which had had nephrorrhaphies without benefit so far as the cure of their symptoms went, had subsequent nephrectomies performed also, without any benefit.

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Mortality of the Operation.—Of the 61 patients operated upon, 2 died as a direct result of the operation, or 3.2 per cent.—one, No. 48, died four days after the operation, of septic peritonitis, revealed by autopsy; the second, No. 53, died on the tenth day postoperatively, very suddenly of pulmonary embolism, although there was no autopsy to confirm this diagnosis. This latter patient had been doing well, with no unfavorable symptom—no temperature nor apparent infection. Urine showed heavy trace of albumin. On the tenth day, without premonition, she became cyanosed and dyspnœic, and died in twenty minutes. This mortality will surely in the future become smaller than the above figures, which are about double more than they should be, since the death from septic peritonitis was exceptional and should have been avoided. There are not sufficient dangers in the operation itself to prevent our recommending it to patients who really stand in need of it.

Results as to Relief of Symptoms after Operation.—The cases reported upon were all those who have ever been operated upon for movable kidney in the Hospital, a period of time extending from May, 1888, to April, 1901; none reported upon have had the operation performed later than six months ago. Of the 61 cases, 2 died in the Hospital as the result of the operation, leaving 59 to consider. One other died two months after the operation, of rapid phthisis, which leaves 58. Of these 58 patients, 42 have been able to be reached personally or by letters, and in many cases personally examined or a report of examination by their physicians has been sent. Of these 42 cases, 22, or 52.3 per cent., have said that they were cured of the symptoms dependent on the movable kidney, while 15, or 35.7 per cent., have reported that they were benefited, 8 of these greatly benefited, 7 only slightly, while 5, or 10.9 per cent., have not been improved at all by the operation.

It has been well said that statistics may be made to prove anything but facts, so that I refrain from drawing too strong conclusions from these few cases. It is unfortunate that it has been only so recently recognized that the other abdominal viscera may be associated with movable kidney, consequently the older histories do not contain any reference to the condition and position of the other abdominal viscera; hence we are unable to tell how many of our cases were associated with more or less general enteroptosis. Of the later histories, five are noted as having a general enteroptosis.

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One of these had a double nephropexy at the Presbyterian Hospital, with but slight relief of symptoms. The other complications mentioned in the records are the following: Gastric indigestion nearly heads the list and affected 25 patients, constipation was complained of by 28 patients, 9 had had attacks of appendicitis, and the appendices were removed in all 9 at the time of the nephropexy. Three were subjects of attacks of diarrhœa, 1 of attacks of jaundice, 11 patients were suffering from pronounced neurasthenia, 1 patient had had all her life attacks of chorea, 2 patients had markedly retroflexed uteri, 2 had marked lacerated perinea, 1 a slight prolapsus uteri, 2 were very anæmic, 1 very gouty, 2 had chronic nephritis, 1 patient had a movable kidney from which a stone was removed at the time of the nephropexy, 1 had a suppurative pyelitis, 2 had herniæ, both being right-sided femoral.

Of the 5 patients who had general enteroptosis or Glénard's disease, 2 were only slightly benefited, another greatly improved by the nephropexy, 1 of the former had a double nephropexy; 2 were entirely cured of subjective symptoms; of the 4 patients with double nephropexies, 2 were entirely cured, while 2 were not heard from; of the 11 neurasthenics, 5 say they were cured of kidney symptoms as the result directly following the operation, 1 was not in the slightest degree benefited, 2 were greatly benefited, while 2 were only slightly benefited.

Results as to improvement in symptoms of the 9 cases with coincident appendicitis cannot be given, as 2 died shortly following the operation, 3 patients cannot now be found, while, of the 4 remaining, 3 were cured, the other being much improved.

The choreic patient is improved, but not cured.

One case who had retroflexed uterus has been cured, one other has not been heard from, one case with lacerated perineum was cured, one other not heard from, while the patient with prolapsus uteri was cured of her abdominal symptoms. One patient suffered from excruciating dysmenorrhœa causing her to be in bed for two days. Between periods there was also more or less soreness in right ovary. The kidney before operation was found in right iliac fossa. Operation entirely relieved the dysmenorrhœa, and periods are now passed without any pain. One patient with chronic nephritis was cured of her abdominal pains, but died fifteen months later of the organic trouble. The other patient (operation two years

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ago) is still living; was improved by operation, but not cured of her pain. The patient with movable kidney from whose kidney a calculus was removed at operation has been entirely cured of all symptoms, *i.e.*, pain.

Twenty-three cases, or 34.4 per cent. of the whole 61 cases, had complications with their movable kidneys, exclusive of gastro-enteric symptoms. Ten of these, or 43.4 per cent., were cured of symptoms. Nineteen cases, or 31.1 per cent. of the whole number, were uncomplicated, and of these, 12 cases, or 63.1 per cent., were cured.

Improvement was seen in many of the cases only months after the operation. In general, we may say that the cures are most frequent in those cases where pain is the only or chief symptom complained of, unless the diagnosis be wrong; less successful in relieving gastro-intestinal symptoms, and least satisfactory in nervous disorders.

Results as to Permanency of the Fixation.—Thirty-six of the 42 patients have been examined within the past two months. Out of this number, movability of the kidney has occurred in 6 cases, or 16.6 per cent.

Two cases had nephrectomies subsequent to the nephrorrhaphies on account of persistent severe pain, this, too, notwithstanding the fact that the fixation had been permanent. The subsequent operations caused no diminution in the symptoms, nor any benefit.

The urine after almost all the nephrorrhaphies has shown, very nearly invariably, marked temporary disturbances, such as the appearance of albumin in amounts varying from one to ten per cent., numerous casts, and in many instances blood-cells.

Results of Operation.—Out of 42 cases able to be followed, 22, or 52.3 per cent., were cured of subjective symptoms; 15, or 35.7 per cent., were benefited; 5, or 10.9 per cent., received no benefit whatsoever.

Uncomplicated: 19 cases, or 31.1 per cent. of the whole 61. Of these, 12, or 63.1 per cent., were cured. Complicated: 23 cases, or 34.4 per cent. of the whole 61. Of these, 10, or 43.4 per cent., were cured.

Recurrence occurred in 6 cases out of 36 examined, or 16.6 per cent.

Mortality of operation: 2 cases in 61 operations, or 3.2 per cent.

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Comparison of Methods of Operation. — (*See Description of Operations.*)

Parenchymatous sutures used in 27 cases.	No parenchymatous sutures used in 17 cases.
13 patients, or 48.1 per cent. cured	9 patients, or 52.9 per cent. cured
10 " " 37 " improved	5 " " 29.4 " "
2 " " 7 " no benefit	3 " " 17.6 " no benefit
2 died, " 7 "	No mortality.
Recurrence, 4 out of 23 examined, or 17.3 per cent.	Recurrence, 2 out of 13 examined, or 15.4 per cent.

Statistics of other Operators.

Keen: 134 cases, 63, or 47 per cent., were cured; 21 improved; 19 failed; mortality, 2.98 per cent.

Frank: 39 cases, with 21 cures, or 53.7 per cent.

Sulzer and Reinboth: 93 nephrorrhaphies; cured, 55.9 per cent.; improved, 9.7 per cent.; recurrence in 15.1 per cent.; no success in 16.1 per cent.; death in 3.2 per cent. from operation.

Albarran: 64 per cent. successful; 14 per cent. partially successful; 22 per cent. failures.

Neumann: 65.3 per cent. successful; 10.3 per cent. partially successful; 22.07 per cent. failures.

P. Wagner: 51 per cent. lasting and complete cures; 15 per cent. partially successful; 20 per cent. failures.

Küster: 85 cases, 58.8 per cent. cured; 4 affected were men, none of whom was cured; 81 were women. Uncomplicated, 34, or 41.9 per cent. Of these 29 were cured, or 85.2 per cent. Complicated, 47, or 58.1 per cent. Of these, 21 were cured, or 44.6 per cent. Mortality: 2 deaths from pulmonary emboli, or 2.3 per cent.

RÉSUMÉ—PRESBYTERIAN HOSPITAL STATISTICS OF MOVABLE KIDNEY.

Total, 61 cases: 2 occurred in men; 59, or 96.7 per cent., in women; 38, or 64.4 per cent., were married women; 21, or 35.6 per cent., were single women. Of the married women, 22, or 37.2 per cent. of the whole 59, had borne children. Average number of children to each, 2.

Right kidney movable in 53 cases, or 86.8 per cent.

Left kidney movable in 4 cases, or 6.6 per cent.

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Both kidneys movable in 4 cases, or 6.6 per cent.
Average age was 33⅛ years; youngest, 17; oldest, 65 years.
Trauma antecedent in only 7 cases, or 11.4 per cent.

Complications.

Femoral hernia in 2.
Gastro-intestinal indigestion in 25.
Marked constipation in 28; diarrhœa in 3.
Jaundice in 1.
Chronic appendicitis in 9.
Urinary symptoms in 18.
Renal colic in 7.
Renal calculus in 1.
Pyelitis in 1.
Chronic nephritis in 2.
Neurasthenia in 11.
General enteroptosis in 3.
Uterine abnormalities in 5.

Results of Operation.

Forty-two cases followed after operation showed 22, or 52.3 per cent., cured of subjective symptoms. Fifteen, or 35.7 per cent., benefited; 5, or 10.9 per cent., no benefit.

Uncomplicated: Nineteen cases, or 31.1 per cent., of the whole 61. Of these 12, or 63.1 per cent., were cured.

Complicated: Twenty-three cases, or 34.4 per cent. of the whole 61. Of these, 10, or 43.4 per cent. were cured.

Recurrence occurred in 6 cases out of 36 examined, or 16.6 per cent.

Mortality of operation: Two cases in 61 operations, or 3.2 per cent.

CASES TREATED.

Case I.—Mrs. B. D., aged twenty-six. No previous trauma. Pain in right iliac fossa for six months, steady for past month; acute attack twice; in bed three weeks; fever, vomiting, tenderness over appendix; attacks of vomiting; constipated; no urinary symptoms. Urine normal before operation, afterward five per cent. albumin and many casts. Operator, Dr. McCosh. Right kidney very movable, tender; suspicious signs in both apices of lungs. Right nephrorrhaphy with parenchymatous sutures; and large swollen appendix removed

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through lumbar wound by opening peritoneum. Operation, March 25. Discharged, April 18, 1901. Result: Developed phthisis June following the operation, which seemed to have benefited the pain.

Case II.—Miss K., aged thirty-two. No trauma. For five years attacks of indigestion, vomiting, constipation, and dragging pains in right side relieved by lying down; three months ago acute attack of fever, vomiting, tenderness in right iliac fossa. No urinary symptoms; urine normal before and after operation. Operator, Dr. McCosh. Right kidney very movable, can be displaced down into iliac fossa. General enteroptosis. Tenderness, resistance McBurney's point. Right nephropexy with parenchymatous sutures and appendicectomy through lumbar wound. Operation, March 19. Discharged, April 23, 1901. Result: Says operation was a perfect success; very well now in every way. Examination: Kidney well in place and not movable.

Case III.—Miss F., aged twenty-seven. No trauma. One year constant dragging pains in right lumbar region, worst after much walking. Nervous prostration; treatment for eight months. Weak, easily tired, nervous, can't wear corsets. No indigestion; constipated; no urinary symptoms; urine normal before and after operation. Operator, Dr. McCosh. Right kidney can be displaced into iliac fossa. Right nephrorrhaphy with parenchymatous sutures. Operation, April 9. Discharged, May 7, 1901. Result: Thinks operation improved her only slightly—pain, dragging sensation in right side less, but still present. Still suffering from symptoms of neurasthenia, nervous, easily tired. Kidney fixed, palpable.

Case IV.—Miss P., aged thirty. No trauma. Three years constant pain in back, attacks of pain about navel, walking even a block causes pain in right side. Several attacks of right-sided ovaritis with always severe dysmenorrhœa. Worn belt with kidney-pad for a year; much benefit. Troublesome indigestion, constipated; no urinary symptoms. Urine before operation normal; after, one per cent. albumin, many casts. Operator, Dr. McCosh. Right kidney very movable, can be pushed into right iliac fossa. Right nephropexy with parenchymatous sutures. Operation, April 16. Discharged, May 12, 1901. Says she is cured. Can walk now almost any distance without discomfort. Before operation dysmenorrhœa kept her in bed always two days; now has no pain at all, and works through periods without discomfort. Digestion much better; works now easily and steadily. Kidney now palpable, but not movable.

Case V.—G. S., male, aged forty-four; married. Fall on right side two years ago; same night severe pain right lumbar region behind, right thigh, hip. In bed ten days; worked three months, in bed then three weeks with right-sided pains. Not able to work past two months. Lost thirty pounds. No digestive troubles, nor urinary symptoms. Urine before operation normal; after, albumin and casts. Operator, Dr. Eliot. Right kidney very movable, not tender. Right nephropexy. Operation, January 2. Discharged, February 1, 1901. No parenchymatous sutures. Operation absolutely cured him of his symptoms. No more pain; able to work. Kidney not palpable nor movable.

Case VI.—Miss J. L., aged forty-three. No trauma. Right hypochondriac and lumbar pains in attacks three years, shooting down thigh; several a week,

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lasting from one hour to a day, with attacks of nausea and vomiting; constipated. No urinary symptoms. Urine before operation normal; after, albumin marked, casts. Operator, Dr. Eliot. Right kidney movable, tender. Right nephropexy, no parenchymatous sutures. Operation, January 27, 1901. Discharged, February 24. Says operation perfectly successful; no pain in side since, able to work steadily. Kidney examined, not palpable nor movable.

Case VII.—Miss M. F., aged thirty-eight. No trauma. For a year pain and dragging feelings on left side of abdomen. Three years ago right nephropexy in Copenhagen. Indigestion, constipation, nervousness. No urinary symptoms. Urine before and after operation normal. Operator, Dr. McCosh. Examination :- Left kidney quite movable, can be pushed down into right iliac fossa. Right kidney just palpable. General enteroptosis, neurasthenia. Left nephropexy, parenchymatous sutures. Operation, February 7. Discharged, March 1, 1901. Has derived but slight benefit from operation. Opposite kidney, sutured in Copenhagen, has come loose again, causing pain and backache. Easily tired, then pain worse. Left kidney is now held well in place.

Case VIII.—Mrs. B. L., aged twenty-seven. No trauma. For many years occasional attacks of pain and discomfort in right lumbar iliac regions. Worse past year. Nervous, easily fatigued, severe indigestion, constipation. No urinary symptoms. Urine before operation normal; after, albumin casts. Operator, Dr. McCosh. Right kidney very movable into iliac fossa. Right nephrorrhaphy, parenchymatous sutures. Operation, March 15. Discharged, March 24, 1901. Result: Gained twenty pounds, general health excellent. Rides wheel now. No pain in kidney, except discomfort when very fatigued, cured by rest. Examination: Kidney well placed, not movable.

Case IX.—Mrs. A. W., aged forty-three. Six children. Two years ago attack of pain in right iliac fossa for a week. Similar attack three months ago, but not well since. Pain there, weakness, flatulence, indigestion, constipated. No urinary symptoms. Urine before operation, normal; after, albumin and casts. Operator, Dr. McCosh. Right kidney quite movable. Tenderness over appendix. Right nephropexy, parenchymatous sutures. Appendicectomy (intermuscular laparotomy). Operation, November 2. Discharged, November 18, 1900. Result: Perfectly cured of all symptoms, gained twenty-five pounds. Kidney palpable, firmly fixed.

Case X.—Miss C. L., aged thirty-five. Right-sided fall ten years ago. Many years pains in right lumbar region, gastro-intestinal disturbances, no appetite, constipated. Attacks of increased frequency of micturition, small amounts. Urine before operation normal; after, albumin and casts. Operator, Dr. McCosh. General enteroptosis. Stomach came down to anterior superior spine. Right kidney very movable, lies in right iliac fossa. Left kidney not palpable. Is neurasthenic. Right nephropexy, parenchymatous sutures. Operation, May 24. Discharged June 22, 1900. Result: Deep-felt pain in right side gone. Has more or less backache, poor appetite, is less nervous. Is markedly improved. Examination: Kidney well in place, fixed.

Case XI.—Miss N. S., aged thirty-two. No trauma. For three years attacks of abdominal pains, sometimes general, sometimes localized in right iliac fossa.

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Troubled with round worms. For past four months constant lumbar right-sided pains. Very nervous, attacks of weak feelings. Indigestion, constipation. No urinary symptoms. Urine normal before and after operation. Operator, Dr. Brown. Right kidney very movable. Right nephropexy, parenchymatous sutures. Operation, May 17. Discharged, July 7, 1900. Result: Nervous condition much improved, occasional lumbar pain, not severe, some backaches. Very constipated still. Kidney palpable, but fixed.

Case XII.—Miss M. O'C., aged twenty-six. No trauma. For five years attacks of pain in right side of abdomen, shooting into groin, every few weeks. Much worse at menstrual periods. No stomach disturbances, not constipated. No urinary symptoms. Urine examined, normal before and after operation. Operator, Dr. Brown. Right kidney very movable, tender, enlarged. Operation, July 19. Discharged August 16, 1900. Calculus removed from pelvis of kidney which was drained by rubber tube. Parenchymatous sutures fixed the movable organ. Result: No trouble since operation. Works every day. Hasn't seen a doctor since leaving hospital. Perfectly well. Kidney fixed, not palpable. Has gained thirty-seven pounds.

Case XIII.—Miss A. S., aged thirty-six. No trauma. In past two years numerous attacks of severe right-sided abdominal pains radiating down thigh. One year ago severe attack of gastro-enteritis with colic, hematuria. Never well since. With attacks often jaundice. Indigestion, vomiting, constipated. With attacks has increased frequency of micturition, often hematuria. Urine before operation normal; after operation, albumin, two per cent.; many casts. Normal in six days. Operator, Dr. Eliot. Right kidney readily palpable, very movable; tender over upper abdomen; gall-bladder not palpable. Right nephropexy, no parenchymatous sutures. Result: Only slightly improved. Examination: Kidney palpable but fixed.

Case XIV.—Mrs. L. J., aged thirty-nine. No trauma. Ventrofixation eight months ago in Presbyterian Hospital. Since then pains in right lumbar region, dull and aching, coming in attacks lasting five or six days every four or six weeks. Nausea, vomiting in attacks, constipated. Hematuria twice. Increased frequency in attacks. Before operation, normal; after, trace of albumin, few casts. Operator, Dr. Eliot. Examination: Uterus good position; right kidney movable. Right nephropexy, no parenchymatous sutures. Explored for stone, none found. Operation, March 27. Discharged, April 21, 1900. Result: Only slight benefit from operation. Still has painful attacks, but not so severe or frequent. Kidney palpable, not movable.

Case XV.—Mrs. C. B., aged forty. Three children. No trauma. Four years ago attack of sharp pain in back, running around sides into bladder; fainted, required morphine. No hematuria. In past five months three similar attacks, with several slighter ones. For past ten years always severe backache. Never jaundiced. In bed past month. No stomach trouble, not constipated. No urinary symptoms. Is neurasthenic. Urine examination: Before operation, normal; after operation, albumin and casts. Operator, Dr. Eliot. Right kidney palpably enlarged, tender, very movable. Right nephropexy, no parenchymatous sutures. Operation May 18. Discharged, June 11, 1900. Result:

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Thinks herself practically cured of her kidney symptoms. No backache, which she was never without previously for ten years, unless she lifts something heavy or on feet too much. Examination : Kidney not palpable, fixed.

Case XVI.—Mrs. A. C., aged twenty-two. No children, no trauma. Indefinite abdominal symptoms for years, attacks of right-sided abdominal pain, indigestion, constipation, neurasthenic. Tender over appendix six months ago. Somewhat hysterical. No urinary symptoms. Urine examination : Before operation, normal ; after operation, albumin and casts for a week. Operator, Dr. Hawkes. Examination : Some tenderness over appendix ; right kidney quite movable, somewhat tender, not enlarged. Operation, May 1. Discharged, June 16, 1900. Right nephropexy, no parenchymatous sutures. Abdominal appendicectomy. Result : Considerable improvement in local pain, but nervous symptoms still present, but to a still less extent. Examination : Kidney became loose in one year, then nephrorrhaphy in London.

Case XVII.—Miss M. A., aged thirty-six. No trauma. For four years pains and soreness in right lumbar region and back. Severe dysmenorrhœa ; no digestive troubles. Constipated. Micturition increased in frequency, burning. Urine normal before and after operation. Operator, Dr. McCosh. Examination : Right kidney movable, not tender. Marked retroflexed, retroverted uterus. Right nephrorrhaphy, parenchymatous sutures, curettement. Alexander operations attempted, but neither ligament could be found. Result : Says kidney operation "very successful." Pain has left the right lumbar region ; suffers a good deal from the malposition, retroflexion of the uterus, for which she now wears a pessary with relief. Examination : Kidney not palpable nor movable.

Case XVIII.—Mrs. M. S., aged forty-three. Three children. No trauma. For past ten years painful attacks at intervals of from two weeks to four months in right hypogastrium, radiating into right back and down abdomen. Vomits during the attack. Bowels regular. Passes large amount of urine at end of the attack. Urine before operation contains albumin and casts; after operation large amounts of both. Operator, Dr. Eliot. Right kidney quite movable. Has chronic nephritis, which was verified by appearance of kidney at operation. Right nephropexy, no parenchymatous sutures. Operation, January 27. Discharged, February 25, 1899. Result : Is improved in health, pains in side better but still present after walking. Is emaciated, furunculosis of buttocks, vaginal discharge profuse. No appetite, evidently all due to the nephritis. Kidney well in place, vaginal examination negative.

Case XIX.—Mrs. F. S., aged forty-six. One child. No trauma. Five years ago ovaries and tubes removed, also laparotomy for rectal prolapse. Has indefinite pains in back and right side of abdomen. Is nervous, marked dyspepsia, attacks of diarrhœa, increased frequency of micturition. Urinary examination : Before operation, normal ; after, albumin and casts. Operator, Dr. Briddon. Both kidneys movable, the right more so ; neurasthenic. In hospital April 8 to 18, 1899, for observation. Right nephropexy, without parenchymatous sutures. Operation, September 9. Discharged, October 13, 1899. At the operation kidney found turned. External border anteriorly, pedicle

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presented posteriorly in wound. Result: Has not received any benefit from the operation. Symptoms just the same now as before. Examination not made.

Case XX.—Mrs. L. L., aged thirty-four. No trauma. Three years ago something gave way in right side of abdomen. Continual pain there since. No stomach symptoms. Bowels regular. No urinary symptoms; urine normabefore and after operation. Operator, Dr. Briddon. Examination: Right kidney very movable. Right nephropexy, without parenchymatous sutures; operation, March 29. Discharged, April 28, 1899. Result: Has not been improved by the operation; pain in the side has continued. Examination shows right kidney quite movable, tender, not enlarged.

Case XXI.—Mrs. I. B., aged forty-one. Four children. Ten years ago first noticed pain in right side of abdomen and back, made worse by walking. Eight years ago felt movable mass in right side of abdomen. One year ago similar mass in left side of abdomen: any work causes much discomfort; never had any urinary symptoms. Urinary examination: Before each operation, normal; after, about ten per cent. albumin and many casts and red blood-cells. Considerable digestive disturbance; very constipated. Dr. McCosh performed all three operations. Parenchymatous sutures used in each case. Examination before operation: Both kidneys very movable. Slight prolapsus uteri. Operation, double nephropexy, October 17, 1899. This relieved symptoms for a month, when pains returned in right side, and she noticed mass there, similar to previous mass. Examination before second operation shows right kidney very movable, can be grasped; left, not palpable. Right nephropexy, second operation, January 1, 1900, parenchymatous sutures. Kidney was fairly adherent at lower end, upper end free, pointed inward and forward. Result: Practically cured; much better than for years previous to the operation. Gained twenty pounds; able to do own work. Examination: Left kidney not palpable; right kidney felt beneath costal arch, fixed; lower pole easily felt.

Case XXII.—Miss T. O'H., aged twenty. No trauma. For past ten years variable pains in left side of abdomen, dull, worse after walking, worse in winter than in summer. Past six months constant and severe. Sometimes severe right-sided abdominal, painful paroxysms; headaches, nervous. No stomach symptoms, not constipated. No urinary symptoms; urine normal before and after operation. Operator, Dr. McCosh. Parenchymatous sutures, right nephropexy. Kidney came down to navel and can be held there. Operation, March 25. Discharged, April 2, 1898. Fatty and fibrous capsules, very adherent from inflammation. At operation pleura opened below twelfth rib, followed by pneumothorax, condition became grave. Air aspirated from chest several times. Result: Letter from her physician says: Remained perfectly well for six months after operation, when paroxysms and pain returned with increased severity. April, 1900, right nephrectomy. Well for three months, when neuralgia, as severe as before, returned in stump, back, and opposite kidney; severe headaches, nervous. Has derived no benefit from either operation.

Case XXIII.—Miss M. R., aged twenty-five. No trauma. One year pain in back and right side, no colic. Feels something moving up and down side. Head-

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aches, nervous, no indigestion, constipated. Increased frequency micturition; urine normal before operation; after, albumin, blood-cells, and granular blood-casts. Right kidney moves below navel and freely movable about abdomen. Left kidney can be pushed into iliac fossa. Operator, Dr. McCosh. Operation, March 14. Discharged, May 11, 1898. Double nephropexy, parenchymatous sutures. Patient not able to be found, so no result obtained.

Case XXIV.—Mrs. M. L., aged thirty-five. Two children. No trauma. Two years ago, severe attack of right-sided abdominal pain, non-radiating, lasting six hours; similar attack three months ago; since then constant right-sided pains. No digestive symptoms, not constipated. No urinary symptoms; before operation urine normal; after, large amount of albumin and casts. Right kidney comes down to navel, can be held there. Operator, Dr. Briddon. Right nephropexy; no parenchymatous sutures. Operation, June 15. Discharged, July 16, 1898. Result: No attacks of pain since operation. Thinks herself cured. Has some sensation of weight in right side of abdomen on lifting arm, and pulling feeling. Examination: Kidney well in place, fixed.

Case XXV.—Mrs. A. L., aged forty-five. Five children. No trauma. Perineorrhaphy twice, thirteen and fifteen years ago. One and a half years ago, attacks of colicky pains every one to four days, lasting one to six hours, growing worse. Pain commences two inches to right of navel, radiates over whole abdomen, which becomes tender. Relieved by large amounts of whiskey. No digestive disturbance, not constipated, no urinary symptoms; urine normal before and after operation. Right kidney enlarged, movable. Operator, Dr. Brown. Right nephropexy, July 26, 1898. Discharged, August 27, 1898. Parenchymatous sutures. Two months after operation, kidney became loose again. Right nephropexy, St. Luke's Hospital; since then perfectly well.

Case XXVI.—Miss I. M., aged seventeen. No trauma. One year ago pains on left side of abdomen, radiating back and right side. Came on several times a day, particularly after walking. Binder of no benefit; attacks of chorea all her life. No indigestion. Very constipated. No urinary symptoms. Urine normal before operation; after each operation, albumin, casts. Right kidney very movable. Operator, Dr. McCosh. Right nephropexy, parenchymatous sutures. Operation, November 21, 1898. Discharged, December 18. She derived no benefit from this first operation. Right kidney became movable again. Pain in right side constantly. Second operation: Right nephropexy, parenchymatous sutures. Operation, November 28. Discharged, December 23, 1899. Result: Considerably benefited, but not cured. Has some pain in right side occasionally, but not so severe. Examination: Kidney not movable, palpable.

Case XXVII.—Mrs. K. W., aged thirty. Four children. No trauma. For nine years attacks of abdominal pains, relieved by tightening towel about abdomen. Lately much worse. Semi-invalid. Indigestion, no constipation, no urinary symptoms. Urine examination: Before operation, normal; after operation, one per cent. albumin, casts, pus. Most marked case of movable kidney, which can be pushed all about right abdomen. Operator, Dr. Eliot. Right nephropexy, no parenchymatous sutures. Operation, July 13. Discharged, August 20, 1896. Died in childbirth, four years after operation. Was cured

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of kidney symptoms by operation, as she was perfectly well up to time of death, able to do all her own work. Gained in weight.

Case XXVIII.—Miss M. L., aged nineteen. Right-sided trauma eight years previously. For four years backache, right-sided abdominal pains felt after walking. The past year pains more acute and constant. Indigestion, no constipation, no urinary symptoms. Urine before operation, normal; after operation, albumin and casts. Right kidney movable, felt hand's breadth below costal arch, can be pushed back. Operator, Dr. Briddon. Right nephropexy, no parenchymatous sutures. Operation, September 9. Discharged, October 9, 1896. Much benefited by operation, but not free from backache. Drawing feeling in right side. Appendix removed, Presbyterian Hospital, October 15, 1901. Examination: Kidney palpable, fixed well in place.

Case XXIX.—Mrs. E. T., aged thirty-six. No trauma. Operation for prolapsus uteri one year ago; no recurrence. Not well since operation; weak spells; cardiac palpitation; attacks of sharp pain in right lumbar region, shooting down thigh; nauseated; no appetite; very constipated; micturition, burning sensation. Examination of urine: Before operation, normal: after, albumin ten per cent., and blood-casts. Emaciated; anæmic; mass in right side of abdomen not thought to be kidney, which itself was felt to be movable. Operator, Dr. Briddon. Exploratory laparotomy: Nothing found except movable kidney, not sutured on account of patient's condition. Operation, September 16. Discharged, October 19, 1896. No news from this patient.

Case XXX.—Miss F. B., aged thirty-four. Three years ago some operation for malposition of uterus. One year ago, while lifting trunk, something snapped on right side, felt faint. Six months after, felt mass on right side, rolled about and became caught, causing fearful pains. These attacks left her exhausted and nauseated. Constipated; never any urinary symptoms; urine, normal before and after operation. Examination: Right kidney freely movable; on standing, can be felt below navel, upper edge palpable. Operator, Dr. McCosh. Right nephropexy, with parenchymatous sutures. Operation, February 25. Discharged, April 8, 1897. Result: Marked benefit followed operation; still suffers from occasional pain, but well satisfied with result. Kidney palpable, not movable nor tender.

Case XXXI.—Mrs. A. L., aged thirty-one. No trauma. In 1894, both ovaries and tubes removed. For past three years pain on right side of abdomen. Feels lump there; for two weeks great tenderness on right side, can't work; Profuse foul vaginal discharge. No stomach symptoms; not constipated. Urinary symptoms: Urinates every hour; normal before and after operation; no tubercle bacilli found. Anæmic; poorly nourished. Right kidney palpably movable. Operator, Dr. McCosh. Right nephropexy, parenchymatous sutures. Appendix removed through lumbar wound. Result: No trace of patient found.

Case XXXII.—Miss H. G., aged twenty-four. No trauma. Past six months pains in back and right side. Has felt mass on right side which she can move; three months ago appendix removed, and curettement in Bellevue. Pains not improved; vomits occasionally; has increased frequency of micturition; pain is at times accompanied by copious discharge of urine, which shows trace of

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albumin. Examination: Neurasthenic; right kidney comes down to navel. Operator, Dr. Brown. Operation, right nephropexy, parenchymatous sutures. Operation, July 23. Discharged, August 23, 1898. Right ovariotomy, October, 1898, in Post-Graduate Hospital. Result: Is much stronger now than before operations; is very much better; practically cured, because chief annoyance before was this movable mass which she felt. Palpation now shows no sign of kidney.

Case XXXIII.—Mrs. S. A., aged thirty-five. Fell five years ago on right side against balustrade. For past four years constant, burning, twisting pain on right side, at the level of costal margin. No indigestion, nor constipation, nor urinary symptoms. Urine examination: Before operation, normal; after operation, trace of albumin. Right kidney movable, tender, not enlarged. Operator, Dr. Briddon. Right nephropexy, without parenchymatous sutures. Operation, June 26. Discharged, August 14, 1896. No trace of patient since operation.

Case XXXIV.—Mrs. E. P. No children. No trauma. For six months dragging, dull pain in right lumbar region; no stomach disturbances; not constipated; no urinary symptoms. Urine examination: Before operation, normal; after, trace of albumin, and few casts. Examination: Right kidney felt movable, iliac fossa tender, not enlarged. Operator, Dr. McBurney. Right nephropexy, without parenchymatous sutures. Operation, May 6. Discharged, June 7, 1896. No subsequent trace of patient found.

Case XXXV.—Mrs. M. K., aged thirty-seven. No children. No trauma. For eight months attacks of abdominal colic and backache; pain radiates into pelvis; at times cannot wear corset on account of abdominal distention. No stomach disturbances; occasional attacks of diarrhœa. For past eight months with above abdominal attacks came incontinence of urine; at times increased in amount; at others, scanty. Urine normal, both before and after operation. Examination shows movable mass in right abdomen, the size and shape of kidney; can push it about. Operator, Dr. Briddon. Right nephropexy, without parenchymatous sutures. Operation, April 29. Discharged, June 3, 1896. Result: She says it was fully six months after the operation before pains ceased in side, since then perfectly well; entirely satisfied with physical condition; has not "done any doctoring" since operation.

Case XXXVI.—Mrs. J. M., aged thirty. Two children. No trauma. Very neurotic. For eight years small right femoral hernia. Five years ago noticed herself movable kidney, causing dragging, ailing pains in side. No stomach disturbances; constipated; no urinary symptoms. Urine normal, before and after operation. Examination: Right kidney very movable. Complications: Right femoral hernia, hæmorrhoids, and endometritis. Right nephropexy, parenchymatous sutures; radical operation for hernia same time. Operator, Dr. McCosh. Operation, June 2. Discharged, June 29, 1896. Result: The hernia operation complete success; no sign of recurrence. Pain has not entirely left side, but is much improved; kidney was not examined.

Case XXXVII.—Mrs. G. W., aged twenty-eight. No children. No trauma. Six weeks ago while walking, a sudden sensation as though something had given way in abdomen, followed by dull, aching pain in right side and down right

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thigh; could not walk for three days. During this time did not pass much urine and feet were swollen. Since then has had several other less severe attacks, Headaches; no indigestion; constipated, urine scanty at times, then profuse. Urine examination: Normal before and after operation. Right kidney very movable, slightly tender, not enlarged. Right femoral hernia. Operator, Dr. McCosh. Right nephropexy, parenchymatous sutures. Operation, March 24. Discharged, April 28, 1896. Result: No further trace of patient found.

Case XXXVIII.—Miss S., aged thirty-two. No trauma. Ten months ago passed blood in urine, followed by sharp pains in right renal region, shooting toward bladder; fever; vomiting. Required morphine. In bed then one month with pains over appendix. July, 1895, appendix removed by Dr. Maurice Richardson. No pain since over appendix, but three months ago, and since, pain over kidney on right side. No indigestion, bowels regular. Micturition painful, frequent, worse after walking. Passes pus with urine. Examination of urine: Before operation, trace of albumin, no casts, few pus-cells; after operation, albumin ten per cent., pus, and blood. Right kidney very movable. Operator, Dr. McBurney. Right nephropexy, without parenchymatous sutures. Operation, January 23. Discharged, March 24, 1896. Result: No trace of patient found.

Case XXXIX.—Mrs. M. R., aged thirty-four. No trauma. One child. Eight weeks ago sharp attack of pain over right kidney, radiating to back; constantly present since. Under observation two weeks in hospital. No digestive, urinary, nor intestinal symptoms. Urinary examination: Before operation twenty per cent. albumin, pus, blood, casts; continued the same after operation. Operator, Dr. Briddon. Examination: Right kidney movable, tender. Right nephropexy, without parenchymatous sutures. Piece taken from kidney at time of operation showed chronic interstitial nephritis. Operation, February 26. Discharged, April 8, 1896. Result: Operation entirely relieved her of all pain in kidney. Died two years later of nephritis.

Case XL.—Mrs. A. T., aged twenty-six. No children. No trauma. For past three years dull pains in right side of abdomen and back. No digestive nor intestinal troubles. Is neurasthenic. Occasionally micturition painful. Urinary examination: Before operation normal; after, albumin three per cent.; casts These continued two weeks. Examination: Right kidney fairly movable. Operator, Dr. Briddon. Right nephropexy, no parenchymatous sutures. Operation, January 29. Discharged, February 25, 1886. For three and a half years quite well, for past year pain in right side, nearly as bad as before, and she feels the kidney and pushes it back in place. Personal examination does not elicit movability of kidney, but have put it down under recurrence. Is neurasthenic.

Case XLI.—Mrs. L. F. B., aged forty-two. One child. Six years ago sudden attack of sharp pains on left side of abdomen, radiating down thigh. In bed several weeks. Many similar attacks; sometimes in these attacks uræmic symptoms developed, somnolence, severe headaches, decreased amount of urine passed. Very nervous, insomnia, no appetite, vomits in attacks. Lost twenty pounds. Constipated, micturition increased frequency, painful. Examination of urine before and after operation always showed albumin two per cent. and

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some pus. Has been in the hands of numerous specialists. Operator, Dr. McBurney. Both kidneys freely movable, slightly tender, not enlarged. Right one rests most of the time in right iliac fossa. Complications: Neurasthenia, gouty diathesis, uterine fibroids, suppurative pyelitis. Operation, December 27. Discharged, January 15, 1896. Double nephrorrhapy, no parenchymatous sutures. Result: Considers herself cured. Sleeps well, good appetite, gained twenty-five pounds. No urinary symptoms since operation; one or two painful attacks on right side, but not at all marked. After fatigue, slight dull ache on right side. Is able to do her work very well. Examination shows left kidney not palpable, fixed. Right kidney has fallen some from its original position, but is fixed.

Case XLII.—Mrs. A. H., aged thirty-five. No children. No trauma. For past five years attacks of vomiting, abdominal pains radiating to back and shoulders. Six months ago ovaries were removed on account of dysmenorrhœa. Symptoms improved since. Has been treated for bladder troubles. Flatulence, vomiting, constipation, very great frequency of micturition. Examination of urine, normal before and after operation. Is anæmic. Right kidney may be moved all about right side of abdomen as low as into pelvis. Was under observation in the Medical Division from October 16, to November 5, 1895. Operation there advised. Operator, Dr. McCosh. Right nephropexy, parenchymatous sutures. Operation, November 7. Discharged, December 4, 1895. Result: No trace of patient since.

Case XLIII.—Mrs. S. H., aged forty-four. Three children. No trauma. For past six months attacks of pain in right lumbar region lasting a week, with dizziness and vomiting. Pain is localized, severe. Constipated; no urinary symptoms. Examination of urine: Before operation, normal; after operation, trace of albumin and casts. Examination: Right kidney can be moved about abdomen and pushed into iliac fossa. Operator, Dr. McCosh. Right nephropexy, parenchymatous sutures. Operation, November 4. Discharged, December 14, 1895. Her husband says she is practically cured, has excellent health. Perfectly well for four years after the operation, then had a slight attack of pain, weak feeling on right side, vomited. Examination shows kidney not palpable, fixed, Abdomen fat, pendulous, has a probable general enteroptosis.

Case XLIV.—Miss M. P., aged thirty-five. Ten years ago had attack of peritonitis. One year ago double ovariotomy for tuberculosis was performed, also double cervical lymphatic gland extirpations. Past ten years periodical attacks of sharp, cramp-like pains in right lower abdomen, vomiting, prostration for several days, not constipated. No urinary symptoms. Before operation, examination of urine normal; after operation, blood in urine; micturition painful. Operator, Dr. McCosh. Right kidney easily felt, quite movable; tenderness over cæcum. May 9, 1895, laparotomy, but no appendix found. Operation, May 18. Discharged, July 28, 1895. Right nephropexy, parenchymatous sutures. Result: Is in excellent health now. Perfectly cured. Gained thirty pounds. Right kidney felt fixed just above anterior iliac spine, not movable.

Case XLV.—Miss J. McG., aged twenty-four. No trauma. Has pains in right side, made worse by fatigue; no urinary nor digestive symptoms. Exam-

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ination of urine, normal before and after operation. Operator, Dr. Briddon. Right kidney very movable. After observations, in Medical Division, nephrorrhaphy advised. Right nephropexy, no parenchymatous sutures. Operation, May 1. Discharged, July 24, 1895. No subsequent trace of patient found.

Case XLVI.—Miss K. O., aged thirty. Had previous trauma. Four years ago, after lifting heavy weight, felt pain in right groin, passing up back to right shoulder. Since then dragging, pulling pains in right side of abdomen. Has had to give up work. No acute attacks. For three years noticed movable lump in right abdomen. No digestive troubles; constipated. No urinary symptoms. Examination of urine before and after operation, normal. Operator, Dr. Briddon. Examination: Right kidney very movable, not tender. Right nephropexy, parenchymatous sutures. Operation, April 3. Discharged, May 13, 1895. Result: Perfectly well for two years after operation. Married soon after leaving hospital. Died of some unknown acute disease.

Case XLVII.—Mrs. N. P., aged thirty. Three children. No trauma. For one year sharp pains in left lumbar region and back. Headaches, dizzy spells. Pain worse after long standing or walking. Pain shoots down left thigh. Urination relieves the lumbar pains. No digestive or intestinal symptoms. For past month frequent micturition. Examination of urine before and after operation, normal. Operator, Dr. McCosh. Examination: Badly lacerated perineum. Left kidney very movable; when displaced, pain is felt. Perineorrhaphy, right nephropexy, parenchymatous sutures. Operation, January 16. Discharged, February 21, 1895. Result: Impossible to trace patient.

Case XLVIII.—Mrs. C. D., aged twenty-six. One child. No trauma. Ten years ago began attacks of pain in right hypochondrium, shooting across abdomen, at intervals of several months. Past two years attacks severer, shooting down thigh. Pain somewhat relieved by kidney pad. In Presbyterian Hospital, September 5 to 27, 1894, then advised to wear pad. Pain much worse for past three months; vomits in attack; no urinary symptoms. Urinary examination negative before operation; after, it contained ten per cent. albumin and many casts. Operator, Dr. McCosh. Examination: Right kidney very movable. Right nephropexy, parenchymatous sutures. Operation, February 26, 1895. Died, March 2, 1895. Autopsy showed septic peritonitis and appendicitis.

Case XLIX.—Mrs. M. N., aged sixty-five. Three children. No trauma. For past five months dull aching pains in right side of abdomen; constant; unable to work. Attacks of nausea, vomiting, constipated. No urinary symptoms. Before and after operation, urine normal. Operator, Dr. McCosh. Examination: Right kidney very movable. Exploratory laparotomy followed by right nephropexy, parenchymatous sutures. Operation, July 7, 1894. Discharged, August 16. Result: Immediately after leaving hospital began to gain strength, able to attend to household duties; always spoke of feeling well. In January, 1897, died, her doctor says of endocarditis and cirrhosis of liver.

Case L.—Mrs. J. H., aged twenty-five. Two children. No trauma. One year ago began to have frequent micturition and attacks of tenesmus. These symptoms became very severe. In Presbyterian Hospital, May 8 to 10, 1894. Cysto-

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scopic examination of bladder under ether: Right kidney very movable. Palpation of this kidney caused hematuria. No digestive nor intestinal disturbances. Examination of urine before operation showed trace of albumin and few casts. Complication: Cystitis. Operator, Dr. McBurney. Right nephropexy, no parenchymatous sutures. Operation, July 11, 1894. Discharged, August 4. Result: Not benefited in any way by nephropexy. Tenesmus and increased micturition continued. In March, 1895, Dr. McBurney performed right nephrectomy. This in turn gave no relief. Urinates now about every fifteen minutes; dependent on morphine suppositories.

Case LI.—Mrs. I. H., aged fifty-seven. Three children. Distinct fall on back three years ago; since then, back somewhat tender on standing, and right side of abdomen aches. For past two years has noticed lump on right side, which she can move about. Binder does no good. Hasn't been able to do housework for six months. No indigestion; constipated; no urinary symptoms. Urinary examination normal before and after operation. Operator, Dr. McCosh. Tumor on right side (kidney) patient moves up under ribs and down into pelvis, where it is felt by vagina. Right nephropexy, parenchymatous sutures. Operation, April 29. Discharged, June 2, 1894. Result: Operation, seven years ago; is now sixty-five years of age and in perfect health. Since operation does entire work of ten-room house, cooking, etc., without help of maid. No pain. She says she is a "well woman." Palpation does not reveal kidney.

Case LII.—Mrs. R. Z. One child. No trauma. Past five months constant severe pain in right lumbar iliac region; no digestive, intestinal, nor urinary symptoms. Urinary examination: Before operation, normal; after operation, six per cent. albumin and few granular hyaline cases. Operator, Dr. McCosh. Examination: Both kidneys palpable. The right very movable. Lacerated cervix. Tenderness over appendix. Operation, November 7. Discharged, December 7, 1899. Right nephropexy, parenchymatous sutures. Impossible to remove appendix through lumbar wound, so laparotomy performed. Result: No trace of patient can be found.

Case LIII.—Miss S., aged twenty-four. Pain across back three years, worse on standing or walking. Pain worse during menstruation. No effect from kidney support, tonics, etc.; no digestive, intestinal, nor urinary symptoms. Urine examination: Before operation, normal; after operation, albumin thirty-five per cent., and casts. Operator, Dr. McCosh. Examination: Right kidney movable into right iliac fossa. Right nephropexy, parenchymatous sutures through lumbar wound; chronically inflamed appendix removed. Operation, November 2, 1899. Died, November 12. Did very well after operation, except albumin thirty-five per cent., few casts; no temperature nor suppuration. Suddenly on tenth day became cyanosed, dyspnœic, and died in twenty minutes; probably pulmonary emboli.

Case LIV.—Mrs. M. R., aged fifty-six. Six children. No trauma. Difficulty in walking for seven years; dragging pains on right side; palpitation, pressure over heart. Has had operations for lacerated perineum and cervix. Attacks of diarrhœa; no urinary nor digestive symptoms. Examination of urine: Before operation, normal; after operation, two per cent. albumin, and casts. Exam-

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ination: Right kidney very movable. Operator, Dr. McCosh. Right nephropexy, parenchymatous sutures. Operation, June 22d. Discharged, August 1, 1893. Result unknown.

Case LV.—Miss A. M., aged thirty-two. No trauma. For four months variable pains in right side of abdomen, shooting down right thigh; no indigestion; constipated; no urinary symptoms. Examination of urine: Before operation, normal; after, five per cent. albumin, and casts. Right kidney very movable; operator, Dr. McCosh. Right nephropexy, parenchymatous sutures. Operation, May 29. Discharged, July 17, 1893. Result: Says operation was very successful; cured her of all symptoms. Examination: Kidney not palpable, fixed.

Case LVI.—Mrs. D. W., aged thirty-three. Three children. For three years pains in right side of abdomen; later on both sides. Six months ago right nephropexy, giving relief to right-sided pains; left-sided pains becoming worse; has feeling as though something moved about in left side of abdomen; occasional attacks of vomiting; not constipated; increased frequency of micturition. Examination of urine: Normal before operation; after, five per cent. albumin, and some casts. Examination: Left kidney quite movable. Operator, Dr. McCosh. Left nephropexy, parenchymatous sutures. Result unknown.

Case LVII.—Mr. D. I., aged twenty-five. Married. No trauma. For fifteen years paroxysmal attacks of pain on left side. Sometimes free for months, then come in rapid succession; pain very severe; radiates down left groin; no stomach, intestinal, nor urinary symptoms. Urine examination: Before operation normal; after, five per cent. albumin. Examination: Left kidney very movable; no evidence of calculus. Left nephropexy, parenchymatous sutures. Operator, Dr. McCosh. Result: Is better, but not cured of attacks, which are not so frequent nor severe as before; pain in attacks more anterior now than previously. Examination by his own physician: Kidney fixed, tender.

Case LVIII.—Mrs. D. H., aged thirty. Nine years ago had dull pains in right lumbar region, paroxysms of sharp, shooting pains. A year ago ovaries removed for "abscesses." No indigestion nor urinary symptoms; constipated. Examination of urine normal, both before and after operation. Operator, Dr. McCosh. Examination: Right kidney very movable. Right nephropexy, parenchymatous sutures. Operation, July 9, Discharged, August 12, 1890. Result unknown.

Case LIX.—Mrs. P. F. M., aged twenty-five. One child. No trauma. Since confinement, three years ago, pains in right lumbar and iliac regions, running down thigh; pain worse after eating; flatulency; very constipated; frequent micturition; urine, normal. Operator, Dr. McCosh. Examination; Right kidney very movable. Right nephropexy. Operation, May 4. Discharged, June 8, 1892. Result unknown.

Case LX.—Mrs. M. H., aged thirty. Three children. For four years painful attacks on right side of abdomen, with intervals between them; pain very severe. No indigestion, intestinal, or urinary symptoms; urine examination before and after operation, normal. Operator, Dr. McCosh. Examination: Right kidney quite movable. Right nephropexy, parenchymatous sutures. Operation, November 17. Discharged, December 19, 1889. Result unknown.

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Case LXI.—Miss E. C. C., aged twenty-eight. No trauma. For twelve years pains on right side of abdomen; noticed movable mass there; pain worse during menses; nervous, hysterical. No digestive, intestinal, or urinary symptoms. Examination, Dr. McCosh: Right kidney very movable. Right nephropexy, no parenchymatous sutures. First operation performed in Presbyterian Hospital for movable kidney. Operation, May 7. Discharged, May 26, 1888. Result: Says operation cured her of her symptoms, particularly the pains, which have disappeared; has gained weight; able to do her work as nurse. Examination shows kidney palpable, absolutely fixed.

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XI.

THE PATHOLOGICAL CONDITIONS FOUND AT ONE THOUSAND AUTOPSIES.

By John S. Thacher, M.D.

The following table is compiled from the abnormal conditions noted as present in the first thousand cases which came to autopsy under the present administration of the Pathological Department of the Presbyterian Hospital. It covers the period from May 1, 1888, to February 6, 1897.

It does not pretend to absolute completeness. Aside from the imperfections unavoidable in any routine records, indulgence is asked for such omissions as have been due to the imperfect equipment of this department during the early part of this period, to the making of many of the autopsies in emergencies, by inexperienced assistants, and to restrictions imposed by friends or the limitations of time.

It is probable that in nearly every case, even though the autopsy were but partial, the important lesions were found and noted; but it is no less probable that many minor abnormalities were overlooked in the hurried or limited examinations, so that the frequency of occurrence of such less important conditions was undoubtedly greater than appears in the following table. It is hoped, however, that this contribution to statistics in pathology may not be without value in aiding to appreciate the relative frequency of various pathological processes. And such appreciation is undoubtedly of help in our efforts to understand pathological principles as well as in weighing diagnostic probabilities.

Certain conditions, uncertain of recognition at the autopsy-table —such as simple congestions, bronchitis, gastritis, etc.—have been omitted from the list, as have also lesions of parts not usually examined, as the urethra. And the findings are, as a rule, recorded as they appeared on gross examination. Other statistical results to be

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gained from the autopsy records it has been impossible to put into shape for this report, but it is hoped that they may be published another year.

GENERAL CONDITIONS.

INFECTIONS:

Bacterial:

Typhoid fever	30
Septicæmia	54
Erysipelas	2
Tetanus	2
Epidemic influenza	1
General tuberculosis	27

Malarial:

Pernicious malarial fever	1
Chronic malarial poisoning	1

By Other Parasites:

Trichiniasis	2
Tæniæ	3
Ascarides	2

Neoplastic:

General carcinomatosis	10
General sarcomatosis	3
General lympho-sarcomatosis	2

INTOXICATIONS:

Auto-intoxication:

Tetany	1

INTOXICATIONS:

By Other Poisons:

Cocaine	1
Coal-gas	3
Oxalic acid	1
Carbolic acid	2
Arsenic	13
Corrosive sublimate	1
Sulphuric acid	1

DISEASES OF THE BLOOD AND OF NUTRITION:

Pernicious anæmia	3
Leucæmia	3
Purpura hæmorrhagica	1
Diabetes mellitus	6
Rachitis	1
Marasmus	10

GENERAL INJURIES:

Submersion	3
Burns	5
Multiple incised wounds	1

LESIONS OF BRAIN AND ITS MEMBRANES.

MEMBRANES:

Extradural hemorrhage	5
Subdural hemorrhage	22
Meningeal hemorrhage	24
Small hemorrhage in pia	1
Thrombosis of cerebral sinuses	4
Aneurism of basilar artery	1
Thrombosis of sylvian artery	1
Cerebral embolism	6
Chronic internal pachymeningitis	6
Acute meningitis	25
Subacute meningitis	2
Tubercular meningitis	26
Chronic meningitis	1

BRAIN:

Bullet-wound of brain	15
Probe-wound of brain	1

Hemorrhages in Brain:

Frontal lobe	13
Frontal lobe, small	1
Parietal lobe	7
Parietal lobe, small	1
Occipital lobe	3

BRAIN:

Hemorrhages in Brain:

Temporal lobe	5
Temporal lobe, small	1
Corpus striatum:	
Caudate nucleus	6
Lenticular nucleus	10
Internal capsule	8
Optic thalamus	8
Optic thalamus, small	1
Corpus callosum, small	1
Central part of cerebral hemisphere	1
Multiple small hemorrhages in brain	4
Small hemorrhage in cerebral cortex	1
Hemorrhage in lateral ventricle, its origin undiscovered	1
Beneath corpora quadrigemina	1
Pons	6
Pons, small	3
Cerebellum	2

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LESIONS OF BRAIN AND ITS MEMBRANES—*Continued.*

BRAIN :

Hemorrhages in Brain :

Superior peduncle of cerebellum	1
Floor of fourth ventricle, small	1

Softening of Brain :

Frontal lobe	7
Parietal lobe	7
Occipital lobe	2
Temporal lobe	1
Island of Reil	1
Cerebral hemisphere	2
Corpus striatum	4
External capsule	1
Internal capsule	2
Optic thalamus	2
Crus cerebri	1
Cerebellum	1
Atrophy of large part of cerebral hemisphere	1
Acute encephalitis	1

Cerebral Abscess :

Frontal lobe	7
Parietal lobe	4
Occipital lobe	1
Temporal lobe	2
Cerebral tuberculosis	2

BRAIN :

Scars in Brain :

Caudate nucleus	1
Lenticular nucleus	1
Internal capsule	1
Optic thalamus	1

Cysts of Brain :

Large cyst of cerebral hemisphere	1
Frontal lobe	1
Caudate nucleus	1
Lenticular nucleus	3
Internal capsule	1
Optic thalamus	1
Pons	1
Hydrocephalus	1
Tumors of brain	6
Malignant adenoma of parietal lobe, secondary to lung	1
Multiple carcinomata of brain starting from papilloma of choroid plexus of lateral ventricle	1
Sarcoma, primary, of optic thalamus and temporal lobe	1
Sarcoma, primary, of cerebellum	2
Sarcoma of parietal lobe, secondary to breast	1

SPINAL CORD.

Crush of spinal cord	6	Disseminated myelitis	1
Tuberculosis of pia mater of cord	1	Anterior poliomyelitis	1
Suppurative myelitis	1	Spina bifida	1
Chronic myelitis	1	Cancer of spinal cord	1

OTHER DISEASES OF NERVOUS SYSTEM.

Multiple neuritis	1	Insolation	12
Caisson disease	2		

HEART.

Acute pericarditis	52	Brown atrophy of heart	3
Tubercular pericarditis	3	Fatty degeneration of heart	44
Adherent pericardium	42	Acute myocarditis	1
Abnormal fold of pericardium	1	Abscess of heart wall	1
Hydro-pericardium	18	Tuberculosis of heart-muscle	1
Bullet wound of heart	1	Chronic myocarditis	11
Rupture of heart	1	*Endocarditis*	234
Embolism of coronary artery	1	Slight thickening or atheroma	50
Thrombosis of coronary artery	2	Aortic valve	14
Infarction of heart-muscle	6	Mitral valve	22
*Hypertrophy of heart	291	Aortic and mitral valves	10
Cardiac dilatation	101	Aortic, mitral, and tricuspid valves	4
Aneurism of heart	1		

* Those hearts are put down as hypertrophied which weigh over fourteen ounces in males, and over twelves ounces in females.

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HEART—*Continued.*

Endocarditis:
- More serious changes..... 184
  - Aortic valve..... 54
  - Mitral valve..... 51
  - Aortic and mitral valves..... 64
  - Tricuspid and other valves... 13
  - Pulmonary valves..... 2
- The above instances of endocarditis include:
  - Acute endocarditis..... 10
  - Ulcerative endocarditis..... 22
  - Chronic endocarditis..... 202

Thrombi in the heart cavities..... 20
Organized thrombus in left auricle.. 1
Patent foramen ovale..... 10
Incomplete interventricular septum 1
Fourth cusp of aortic valve..... 1
Fourth cusp of pulmonary valve... 1
Leucæmic infiltration of heart-muscle..... 1
Cancer of heart..... 1
Sarcoma of heart..... 2
Hemorrhage in mediastinum..... 1
Abscess of mediastinum..... 3

BLOOD-VESSELS.

Rupture of aorta..... 2
Aneurism of aorta..... 19
Constriction of aorta..... 1
Thrombosis of aorta..... 1
Wound of circumflex iliac artery.. 1
Thrombosis of subclavian vein.... 1
Thrombosis of inferior vena cava.. 1
Thrombosis of cœliac axis..... 1
Thrombosis of iliac vein..... 9
Thrombosis of femoral vein..... 1
Thrombosis of popliteal artery..... 1

ORGANS OF RESPIRATION.

Nose:
- Nasal diphtheria..... 1

Larynx:
- Incised wound of larynx..... 2
- Œdema of glottis..... 1
- Ulcer of larynx..... 5

Trachea:
- Bullet wound of trachea..... 1
- Perforation of trachea..... 1

Pleura:
- Hemorrhage in pleura..... 10
- Acute pleurisy..... 67
- Empyema..... 9
- Tubercular pleurisy..... 5
- Adherent pleura..... 488
- Cancer of pleura..... 1
- Hydrothorax..... 60
- Pneumothorax..... 4

Lung:
- Bronchiectasis..... 7
- Laceration of lung..... 4
- Bullet-wound of lung..... 5
- Thrombosis of pulmonary artery. 1
- Thrombosis of pulmonary vein.. 2
- Hemorrhagic infarction of lung.. 38
- Septic infarction of lung..... 1
- Gangrene of lung..... 12
- Acute lobar pneumonia..... 119
- Broncho-pneumonia..... 80
- Secondary pneumonia..... 5
- Hypostatic pneumonia..... 8
- Abscess of lung..... 16
- Tuberculosis of lungs..... 394
  - Slight tuberculosis of lungs... 142
- Unresolved pneumonia..... 1
- Brown induration of lung..... 37
- Chronic interstitial pneumonia.. 3
- Anomalous form of lung..... 1
- Cancer of lung..... 9
- Sarcoma of lung..... 3

PERITONEUM.

Hemorrhage into peritoneum..... 8
Acute peritonitis..... 105
Peritoneal abscess..... 6
Subphrenic abscess..... 1
Perisplenic abscess..... 1
Abscess of broad ligament..... 4
Other pelvic abscesses..... 11
Tubercular peritonitis..... 15
Adherent peritoneum..... 101
Adherent peritoneum about liver.. 31
Adherent peritoneum about spleen. 11
Adherent peritoneum, pelvic..... 24
Cancer of peritoneum..... 8
Ascites..... 35
Retroperitoneal hemorrhage..... 4
Retroperitoneal abscess..... 5
Sarcoma of retroperitoneal glands.. 1

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ALIMENTARY CANAL.

Mouth :
- Acute stomatitis 1
- Cancer of tongue 1
- Cancer of floor of mouth..... 1

Pharynx :
- Cancer of pharynx..... 1

Œsophagus :
- Perforation of œsophagus..... 1
- Bullet wound of œsophagus..... 1
- Acute œsophagitis..... 1
- Stricture of œsophagus..... 2
- Cancer of œsophagus..... 5

Stomach :
- Bullet-wound of stomach..... 2
- Stab-wound of stomach..... 1
- Hemorrhage in stomach..... 4
- Dilated stomach..... 20
- Ulcer of stomach..... 11
- Perforation of stomach..... 10
- Healed ulcer of stomach..... 1
- Cicatricial stricture of pylorus .. 1
- Cancer of stomach..... 22
- Sarcoma of stomach..... 1

Intestines :
- Bullet-wound of intestines 1
- Rupture of intestine..... 3
- Umbilical hernia..... 2
- Strangulation of intestine..... 10
- Volvulus 2
- Intussusception..... 3

Intestines :
- Hemorrhage in intestine..... 12
- Thrombosis of superior mesenteric artery... 2
- Ulcer of small intestine..... 63
  - Including :
    - Ulcer of duodenum..... 1
    - Ulcer of jejunum..... 2
    - Typhoid ulcer of small intestine 30
    - Tubercular ulcer of small intestine 13
- Perforation of intestine..... 13
- Diverticula of duodenum..... 1
- Diverticula of ileum..... 5
- Meckel's diverticulum..... 4
- Cancer of duodenum..... 2
- Sarcoma of intestine..... 1
- Perforation of colon..... 2
- Acute colitis..... 4
- Ulcer of colon 33
- Diverticula of colon..... 2
- Cancer of colon..... 6
- Appendicitis..... 14
- Stricture of sigmoid flexure..... 1
- Wound of rectum..... 2
- Stricture of rectum..... 2
- Proctitis..... 1
- Ulcer of rectum..... 3
- Perforation of rectum..... 5
- Cancer of rectum..... 6
- Sarcoma of rectum..... 1

LIVER.

- Bullet-wound of liver..... 2
- Laceration of liver..... 8
- Pylephlebitis..... 2
- Infarction of liver..... 1
- Fatty degeneration of liver.....145
- Waxy degeneration of liver..... 7
- Nutmeg liver.....147
- Abscess of liver..... 14
- Tuberculosis of liver..... 17
- Cirrhosis of liver..... 77
  - Hypertrophic cirrhosis 13
  - Syphilitic cirrhosis..... 1
- Leucæmic infiltration of liver..... 1
- Cyst of liver..... 2
- Anomalous form of liver..... 1
- Angioma of liver..... 5
- Cancer of liver..... 21
- Sarcoma of liver..... 2

GALL-BLADDER AND DUCTS.

- Rupture of gall-bladder..... 1
- Gangrene of gall-bladder..... 1
- Cholecystitis..... 3
- Scar of gall-bladder..... 1
- Cancer of gall-bladder..... 1
- Gall-stones..... 68
- Gall-stone in cystic duct..... 2
- Gall-stone in common duct..... 4
- Dilated bile-duct..... 1

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PANCREAS.

Hemorrhage into pancreas	3	Cirrhosis of pancreas	2
Thrombosis of pancreatic vein	1	Cancer of pancreas	7
Necrosis in pancreas	1	Sarcoma of pancreas	1
Atrophy of pancreas	1	Peripancreatic sclerosis	1

SPLEEN.

Laceration of spleen	4	Tuberculosis of spleen	18
Infarction of spleen	38	Leucæmic enlargement of spleen	2
Hypertrophy of spleen	114	Cancer of spleen	1
Waxy spleen	6	Sarcoma of spleen	3
Abscess of spleen	3		

KIDNEY.

Laceration of kidney	6	*Nephritis:*	
Embolism of renal artery	1	Marked, of the granular type, one kidney large, the other small	2
Thrombosis of renal artery	3	One kidney small, granular, and cystic; the other large, of the degenerative type	1
Thrombosis of renal vein	5	Marked, of a mixed type	16
Infarction of kidney	54	Suppurative nephritis	18
Waxy degeneration of kidney	2	Pyelo-nephritis	3
Nephritis:		Tuberculosis of kidney	23
Of the moderate degenerative type	76	Misplaced kidney	1
Of the moderate granular type	70	Leucæmic infiltration of kidney	1
Moderate, of a mixed type	35	Cystic kidney	2
Marked, of the degenerative type, and large	33	Adenoma of kidney	3
Marked, of the degenerative type, small	2	Cancer of kidney	7
Marked of the granular type, and large	64	Pyelitis	13
Marked, of the granular type, and small	90	Hydronephrosis	6
Marked, of the granular type, size not stated	11	Renal calculus	9
		Hemorrhage around kidney	3
		Perinephritic abscess	4

ADRENAL.

Rupture of adrenal	1	Tuberculosis of adrenal	7
Hemorrhage in adrenal	1	Fibrosis of adrenal	1
Thrombosis of suprarenal vein	1	Adenoma of adrenal	4
Infarction of adrenal	2	Cancer of adrenal	3

URETER.

Wound of ureter	1	Tubercular inflammation of ureter	1
Perforation of ureter	1	Double ureter	7
Chronic inflammation of ureter	1		

BLADDER.

Bullet-wound of bladder	2	Tubercular cystitis	2
Rupture of bladder	3	Diverticula of bladder	2
Perforation of bladder	1	Cancer of bladder	1
Hemorrhage into bladder	1	Vesical calculi	2
Cystitis	21		

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PROSTATE.

Hypertrophied prostate	18	Tuberculosis of prostate	2
Abscess of prostate	2		

SEMINAL VESICLES.

Abscess of seminal vesicle	1	Tuberculosis of seminal vesicle	5

VAS DEFERENS.

Tuberculosis of vas deferens	1

EPIDIDYMITIS.

Tubercular epididymitis	5

TESTICLE.

Chronic orchitis	2	Hydrocele	3
Tubercular orchitis	3		

SCROTUM.

Abscess of scrotum	1

PENIS.

Ulcer of penis	1

VAGINA.

Perforation of vagina	2	Cancer of vagina	2

UTERUS.

Rupture of uterus	5	Fibroid of uterus	22
Septic endometritis	21	Cancer of uterus	3

FALLOPIAN TUBE.

Pyosalpinx	7	Tubercular salpingitis	1
Hydrosalpinx	3		

OVARY.

Thrombosis of ovarian vein	2	Cyst of ovary	3
Abscess of ovary	4	Cancer of ovary	1

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LESIONS OF OTHER PARTS.

Wounds :

Wounds of head	1
Bullet-wound of temporal region	1
Bullet-wound of skull	17
Bullet-wound of neck	1
Bullet-wound of vertebræ	1

Fractures :

Fracture of skull	46
Fracture of vertebræ	6
Fracture of humerus	3
Fracture of radius	1
Fracture of ulna	2
Fracture of clavicle	2
Fracture of sternum	6
Fracture of rib	13
Fracture of costal cartilage	1
Fracture of pelvis	4
Fracture of femur	8
Fracture of tibia	4
Fracture of fibula	2
Fracture of tarsus	1

Other Injuries :

Dislocation of vertebræ	3
Rupture of diaphragm	1
Perforation of diaphragm	2

Inflammations :

Osteomyelitis	2
Tuberculosis of vertebræ	4
Acute articular rheumatism	1
Suppurative arthritis	3
Otitis media	3
Mastoiditis	1
Abscess of neck	2
Carbuncle of neck	1
Abscess of arm	1
Abscess of hand	1
Abscess of thumb	1
Tubercular dactylitis	1
Abscess of chest-wall	1
Abscess of abdominal wall	5
Lumbar abscess	3
Ischio-rectal abscess	1
Abscess of thigh	1
Abscess of leg	2

Tumors :

Multiple sarcomata of bones	1
Goitre	2
Cancer of neck	1
Cancer of breast	3
Cancer of rib	2
Sarcoma of chest-wall	1
Sarcoma of sacrum	1

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XII.

A CASE OF DISLOCATION OF THE SPINE RESULTING IN CRUSH OF THE SIXTH CERVICAL SEGMENT—IRREGULARITY IN THE DISTRIBUTION OF THE PARALYSIS.

By A. J. McCosh, M.D., and George A. Tuttle, M.D.

The relation which paralyses both of sensation and of motion bear to nerve-roots and cord-segments, while more or less constant, cannot be defined with positive accuracy by any rules or schematic diagrams. Allowance should always be made for certain variations both in the distribution of the nerve-roots and in the length of the nerve-roots within the spinal canal. As is well known, the roots in different regions of the spine vary considerably in length; and probably also in different individuals there may be variations in the length of the same roots, or, in other words, in the distance between the point of emergence from the bony canal of any given root and its seat of origin in the spinal cord. For example, in the cervical region, the law, which is generally correct, reads that in order to locate the segment of the cord corresponding to any given root, 1 must be added to the number which the root bears (vertebra from which it emerges), or the rule may be stated in other words, viz., the segment from which a given nerve takes its origin is to be found one inch above the point of its emergence from the canal. In the dorsal and lumbar regions a greater distance must be added, but in this article our attention will be confined to the mid-cervical region.

On this subject Gower says: "The vertical distribution of the symptoms varies according to the vertical position of the lesion. Their relations are best marked when the lesion is in the dorsal region of the spinal cord. When it is in the cervical or lumbar enlargement, the upper limit is less distinct because of the complex representation of skin and muscle in the nerve-roots." *

* Diseases of the Nerves and Spinal Cord, p. 231.

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The case to be reported illustrates slight variations. They were not, it is true, of great extent, but still were sufficient to lead us at the time of operation somewhat astray. The tendency in the past has been very general to locate the spinal lesion at too low a point. In the last year or two, however, cases and observations have so accumulated that we are now in a better position to judge of the exact location of the injury, but we must bear in mind the possibility of variations within certain limits, as is illustrated by the case which follows.

The lesion was located in the mid-cervical region, and consisted of what is termed a crush of the cord between the bodies of the 4th and 5th cervical vertebræ, due to a dislocation suddenly made and as suddenly reduced.

According to the diagrams of Gowers, Starr, and other authorities, the 6th cervical segment extends from the middle of the body of the 4th to the middle of the body of the 5th cervical vertebræ, and from the report of the autopsy, and of the microscopical examination which follows, it will be noted that in this region the cord was completely destroyed for a distance of one-third of an inch, and completely degenerated for a considerable distance above and below this area, so that it is apparently correct to state that the entire 6th and lower part of the 5th cervical segment was destroyed and made entirely useless as a source of nerve-energy.

It must be borne in mind, however, that there is some question that the diagram, so long regarded as a standard, which indicates the relationship which spinal segments bear to different vertebræ is not invariably correct.

Case.—Dislocation between 4th and 5th Cervical Vertebræ—Complete Crush of 6th Cervical Segment—Laminectomy.—M. M., female, was on September 27, 1901, when in the act of getting into a folding-bed, struck on her back by the upper erect portion of the bed falling against her shoulders and neck. She was thus pinned down in a doubled-up position where she remained for fifteen minutes before she was extricated. When found, she was unable to move her trunk, and her upper and lower extremities felt numb and powerless. Shortly afterward, there was complete paralysis of the lower extremities and she was unable to close her fists. Retention of urine and obstinate constipation followed. She suffered some pain in the back of her neck and shoulders, but it was not severe.

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She felt numbness in the upper and lower extremities and trunk. Considerable inability to move her arms and forearms was noted. The bladder and rectum were paralyzed. She was admitted to the hospital three days later. She was a large fleshy woman in fair general condition; mind clear. She complained of slight pain in back of neck, of numbness and sensation of pins and needles all over her body. Motor paralysis was complete below the diaphragm. The diaphragm acted normally. There was partial paralysis of arms and shoulders, but she could move them slowly, both in flexion and extension, which movements, however, were diminished at the elbow, and almost completely lost at the wrist. A careful examination of the muscles of the upper extremity was made, with the following results:

No sign of paralysis in the

Pectoralis major or minor.
Trapezius.
Sterno-mastoid.

Slight paralysis of

Deltoid.
Scapular muscles.
Triceps.
Biceps.
Coraco-brachialis.

Marked but not complete paralysis of flexor and extensor muscles of the forearm and muscles of the hand.

The areas of anæsthesia will be seen in the diagrams. In addition to the shaded outline, where anæsthesia was complete, there was a band, not shown in the diagram, running up the inner side of each forearm and arm, about three-quarters of an inch in width, where the anæsthesia was almost complete. The shaded portions indicate loss of sensation to touch, pain, heat, and cold.

According to the information which could be derived at that time from reported cases and from the various schematic diagrams of anæsthetic areas, the lower limit of sensation of the body surface corresponded anteriorly with the 7th or 8th cervical segment, while posteriorly it more nearly corresponded with the 8th cervical or 1st dorsal segment, and that on the arms with the same segments, or even lower. The muscular paralysis also corresponded with the 8th cervical and 1st dorsal segments. The lesion, which apparently

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was an almost complete crush of the cord, due either to a fracture or a dislocation, was considered to be most likely between the 7th cervical and 1st dorsal segments of the cord opposite the 6th and 7th cervical vertebræ.

Immediate operation was advised. Consent, however, was not given until October 5. During the intervening six days the paralysis of the motor and sensory nerves remained practically unchanged.

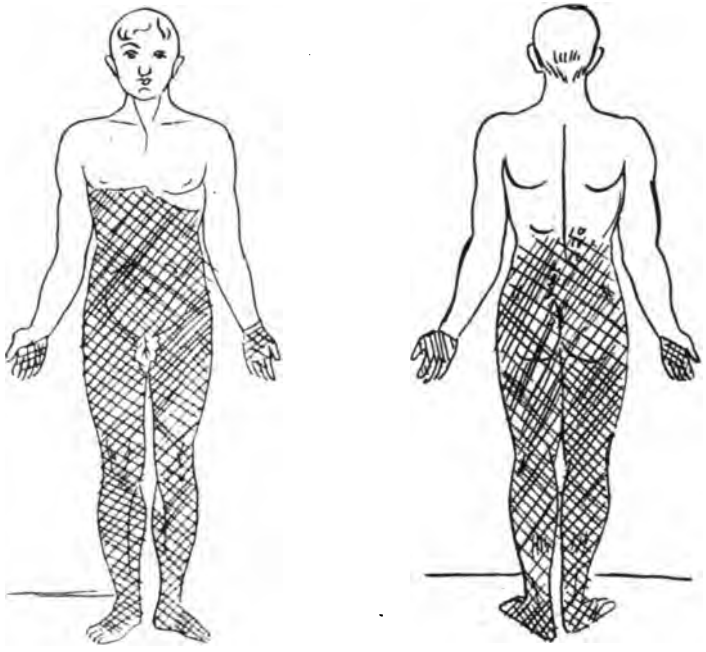

FIG. 1.

The patient, however, developed an evening temperature, and lost considerable flesh and strength.

Operation, October 5.—By means of Schleich's infiltration method, the skin and the subcutaneous tissue were made insensitive. Only once or twice when the patient became very nervous were a few whiffs of chloroform given. An incision, six and a half inches long, was made from opposite the 4th cervical to the 1st dorsal spines. The muscles were rapidly separated from the spines and laminæ, bleeding being controlled by pressure by means of sponges and folds of gauze pressed down by broad retractors which at the

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same time thoroughly exposed the spines and laminæ of the 6th and 7th cervical vertebræ. These were removed by rongeur forceps. The dura looked normal. There was no evidence of hemorrhage or fractured bone. A probe was passed inside the spinal canal upward for two inches and downward for four inches, meeting no obstruction. The dura was opened. The cord, where it was exposed for a distance of two inches from the lower edge of body of the 5th to the upper edge of body of the 1st dorsal vertebra, looked normal. As no obstruction had been encountered by the probe, and as there was evidently no lesion which could be relieved by operation, it was decided not to remove more bone. Accordingly the dura was sutured, also the muscles and skin, with the exception of a space left open for a small gauze drain. Time of operation was forty-five minutes.

The patient recovered from the immediate effects of the operation. There were no signs of shock. No improvement, however, resulted. The temperature, which before operation had ranged between 98.5° F. and 101°, now steadily rose, till, on October 11, it reached 106° F. Extensive bed-sores, with rapidly spreading sloughs, developed on each buttock. The temperature continued to rise, till on the 19th it reached 110°, on which day she died.

Autopsy.—There is an unusual degree of motion between the 4th and 5th cervical vertebræ. Both flexion and extension are exaggerated, and the bodies of those vertebræ can easily be moved backward and forward a short distance upon each other. There is no evidence of fracture or of rupture of ligaments. No extravasation of blood is noticed in the tissues around this joint.

At the level of the intervertebral disk or upper edge of the body of the 4th cervical vertebra, the spinal cord for a distance of one-third of an inch is distinctly soft and pulpy. The finger passed along the surface of the cord sinks into a distinct transverse groove at this point. The lesion affects the upper part of the 6th cervical segment and possibly the lower end of the 5th segment.

Microscopical Examination.—There is a small clot of extravasated blood in the left lateral column which extends upward and downward for more than an inch. In the same lateral column and in the posterior horn of gray matter of the same side there are many other minute extravasations of blood. The relative size and position of the principal clot are seen in the photographs Nos. 1, 2, and

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3. The cord has evidently been crushed at this point, and there is almost complete disintegration of the nerve-tissues throughout the softened area. In some of the sections an occasional fibre or small group of fibres appears to be intact. Above and below the lesion the characteristic degenerations of the nerve-fibres are fairly well-marked. In the upper cervical region the degeneration is confined

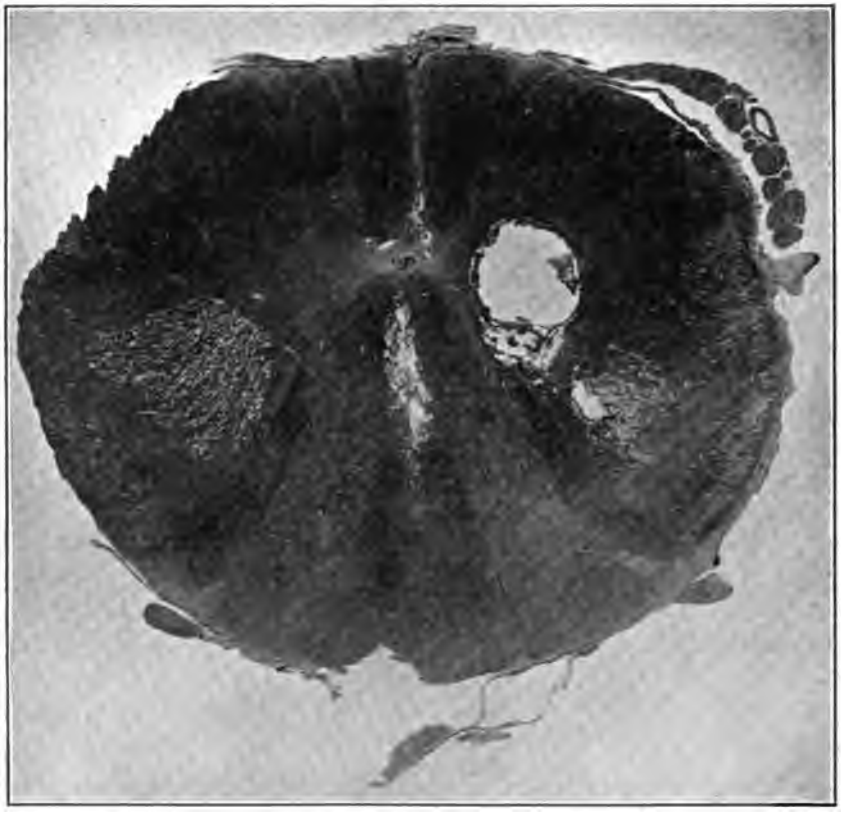

FIG. 2.—Section of cord at the site of the lesion.

to the posterior median columns, and the direct cerebellar and antero-lateral ascending tracts. It is not, however, universal in these regions. Many fibres appear to be normal or only slightly changed. In the dorsal region there is well-marked degeneration of the crossed pyramidal tracts. These changes are seen, in photographs 4 and 5, above and below the lesion.

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In all spinal operations our endeavor should be to locate the lesion as accurately as possible. For this reason it is of great importance that all variations from the normal should be noted and reported.

In the following parallel columns will be seen the variations in the muscular paralyses between the case just cited and those which should occur according to R. Wichmann ("*Die Rückenmarksnerven*") when the 6th cervical segment is destroyed. Perhaps of these the most important is the variation as regards the paralysis of the triceps muscle.

Wichmann.	*Case.*
1. Complete paralysis of— (*a*) Muscles of hand, fingers, and thumb. (*b*) Triceps, and therefore inability to extend elbow.	1. Marked but not complete paralysis of flexor and extensor muscles of forearm and hand.
2. Partial paralysis of— (*a*) Biceps, brachialis, and coraco-brachialis. (*b*) Deltoid. (*c*) Pectoralis, causing inability to adduct the arm.	2. Partial paralysis of deltoids, capular muscles, triceps, biceps, coraco-brachialis.
	3. No paralysis apparent of pectoralis major.

As regards the areas of anæsthesia the correspondence is also nearly, though not quite, exact. The line in the anterior surface of the chest is almost identical with that given by Wichmann; that in the posterior surface is at a point two inches lower. Also, according to the same authority, there should have been "anæsthesia in the entire inner half of the arm, over the entire hand and fingers and on the forearm, except over a small area on the radial side below the elbow, also the middle of the posterior surface of the arm over the triceps." In our case the hands were anæsthetic, but sensation was at no point completely lost, on either the arm or forearm, there being but a narrow band of lessened sensation on the inner side of the forearm and arm.

As will be noted from what has been written, the location of the lesion was one vertebra too low. This was not a matter of importance as regards the result in this instance, but it is usually of importance to ascertain the location of the lesion within the nar-

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rowest possible limits. "One cannot ruthlessly sacrifice spinous processes and laminæ, and a large flap is not practicable, as it is in operations on the brain. The location within certain definite bounds can almost invariably be settled. It is impossible, on account of the anatomic arrangements, to assign a certain lesion to any one segment of the cord, but it is almost always possible to locate a lesion to an area embraced by three spinal segments. The reason for this is evident. There is no spot on the surface of the body, and practically no muscle (with the possible exception of some of the deep,

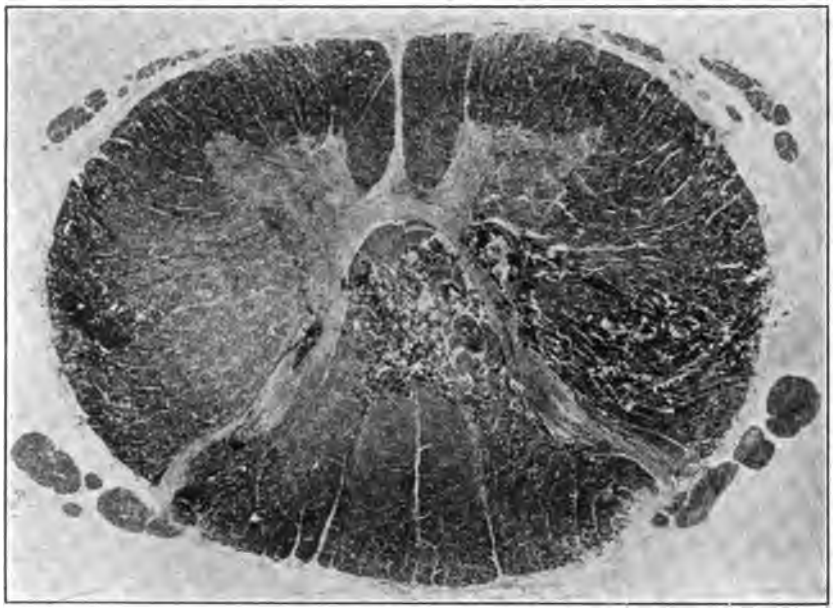

FIG. 3.—Section of cord at the site of the lesion.

small muscles of the back), which is innervated by one nerve-root alone. The anastomosis between the sensory nerves is so perfect that every spot of skin derives its sensation from at least three or more nerve-roots or segments; and every muscle derives its motor power from at least two segments of the cord.

"In addition to this, it is known that the afferent and efferent tracts run up in the substance of the cord for a considerable and, according to location, a variable distance; that degeneration will at times follow up these tracts for a considerable distance, perhaps two

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segments, before it reaches the real nerve-centre in the gray matter of the cord. As a consequence, the cause of a paralysis or irritation of a muscle or of an area of anæsthesia may, instead of being at the segment into which the nerve-root supplying said muscle or spot of skin enters, be located at a point considerably higher up in the cord."*

The injury sustained by this patient was so severe that recovery under any circumstances was impossible. An earlier operation would have been followed by no greater success. The shock of the

FIG. 4.—Section of the cord near the lesion.

operation was insignificant; indeed, an experience of nearly twenty laminectomies done by one of the writers has convinced him that if the operation be done quickly and without useless attention to hæmostasis, its shock and dangers are but slight. For this reason he favors operations in all doubtful cases. Without an exploration it is generally impossible, in cases where the symptoms are severe, to judge whether or not the patient can be benefited by an operation. "As yet we have not sufficient experience or knowledge to make any

* McCosh: Journal of the American Medical Association, August 31, 1901.

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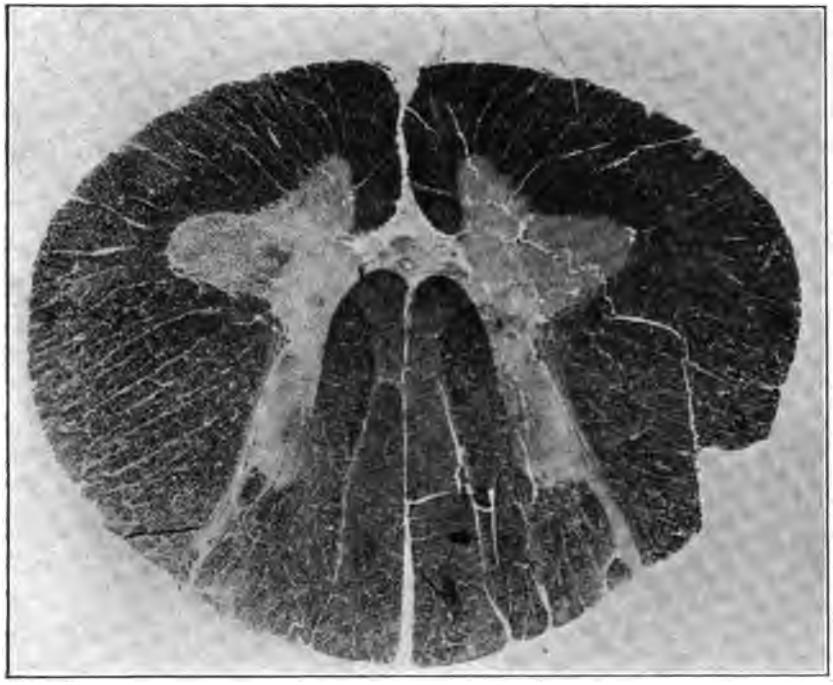

FIG. 5.—Section of the cord above the lesion, showing ascending degeneration.

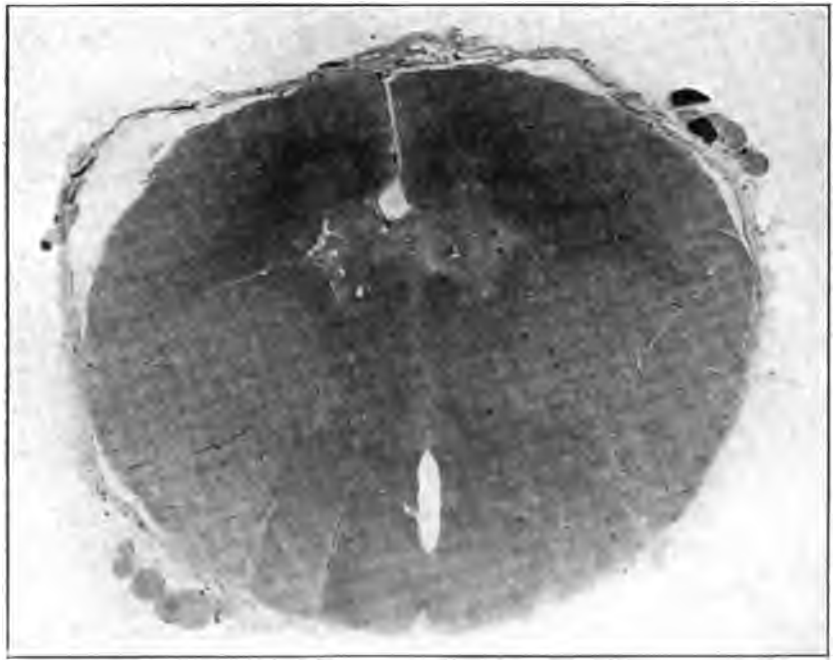

FIG. 6.—Section of dorsal region of cord, 3½ inches below lesion, showing descending degeneration.

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definite statement concerning the early symptoms which indicate complete destruction of the cord. We do know, however, that, if certain symptoms be allowed to persist for days or weeks, the case will be hopeless. It is our duty to make an attempt to relieve these symptoms and their cause before it is too late. It has been stated more than once that, where there is complete loss of sensation, motion, and patellar reflexes in both lower extremities, the symptoms indicate a complete crush of the cord, and that the case is absolutely hopeless. This view, however, is not correct, as has been shown by more than one case where all these symptoms have been present, and yet where, after removal of fragments of bone, recovery has resulted. The following case * is to be added to this list. In this case both deep and superficial reflexes were lost. Had operation been delayed, however, they might have returned."

* McCosh : Journal of the American Medical Association, August 31, 1901.

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XIII.

THREE BLOOD ANALYSES.

By Fred P. Solley, M.D.

The following cases are of especial interest on account of the results of the blood-examinations. One of the cases presents also features of importance from the standpoint of general pathology, and is therefore reported in full with the account of the post-mortem findings. The second case is an example of pronounced eosinophilia due to intestinal parasites. In the third case the presence of the same parasite in the intestine was associated with a grave anæmia possessing some remarkable characters. The etiological relationship in this instance, however, does not appear to be satisfactorily demonstrated—so that it has seemed best to give the complete details of the condition, in the hope that future research may be successful in establishing its identity.

Case I. General Sarcomatosis.—Robert S., Jr., aged eighteen; employed in a piano factory; was admitted to the hospital October 14, 1901, in the service of Dr. James.

Family History.—A brother has heart trouble.

Habits.—Moderate cigarette-smoker. Not alcoholic. Is athletic; quite expert as a pugilist. Had gonorrhœa eight months ago.

Previous History.—Had measles, diphtheria, scarlatina, and varicella as a child. No sequelæ. Never had rheumatism. Was apparently in perfect health until now.

Present Illness.—Five days before admission, while working at his bench, he stooped over, and felt a sudden sharp pain in the left buttock behind the hip-joint. This was followed by a constant dull aching in the same region, aggravated by pressure on the hip or by bending over, but relieved by lying down. There have been occasional paroxysms of sharp pain shooting down the back of the left thigh to the knee, and occasionally into the left groin. During

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these paroxysms the right hip and leg also became painful, but to a lesser degree.

He has been under treatment, but with no relief.

Physical Examination by the Acting House Physician.—Frame large, muscular, well nourished. Does not appear anæmic. Tongue somewhat dry, heavily coated. Pharynx and tonsils appear normal. Pupils equal; react to light and accommodation. Submaxillary lymph-nodes enlarged, and both inguinal chains are palpable.

Heart.—Apex in 4th space, four inches to left of midsternal line. Impulse diffuse, palpable over entire præcordium. Action regular, good force. Second pulmonic sound somewhat accentuated; no murmurs heard. Pulse regular, soft, full; vessel wall palpable. *Lungs:* A few subcrepitant râles at the base of left axilla, otherwise negative. *Liver:* Dulness from 5th space to free margin. Edge not felt. *Abdomen:* Held somewhat rigid. No tenderness, no masses. *Extremities:* Upper normal. Tenderness over course of sciatic nerve on both sides—more marked on left—with extreme sensitiveness on deep pressure. Flexion of thigh—especially when leg is extended—is very painful. The *urine examination* was negative. For five days after entrance the temperature was normal—the pulse ranged from 90 to 118, the respiration from 20 to 32. The pain in hips and thigh, especially on the left side, was continuously severe and kept him awake at night. Profuse sweating was a marked feature. On the third day the leucocyte count was 24,000.

The patient then began to complain also of pain in the chest and arms, of a dull aching character and not localized. He also complained of sore throat, but the pharynx was apparently normal, except for pronounced anæsthesia. The corneal and conjunctival reflexes were also diminished, and these facts, taken in connection with the variable character and situation of the pains, and in the absence of any demonstrable lesions, suggested the possibility of the manifestations being hysterical. With this idea the cautery was used over the painful areas, but brought no relief from the pain. One week after admission, however, the temperature began to show an irregular daily rise, and the pulse, which had been somewhat accelerated throughout, became more rapid, being above 100 almost continuously.

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The leucocyte count, though lower than at first, continued above normal (about 14,000).

The pain and tenderness over the sacro-iliac joints and sciatic nerves, of which the patient complained bitterly, continued unabated. The abdomen now became somewhat distended, and the rigidity, noticed on admission, was more pronounced.

Epistaxis occurred twice.

The pain was somewhat relieved by codeine, but sleep was still much broken in spite of the use of hypnotics.

On October 25, ten days after admission, the leucocyte count was 14,000; red cells, 4,465,000; hæmoglobin, ninety-five per cent.; color index, 0.93.

A differential count of 300 leucocytes gave the following result:

Polymorphonuclear neutrophile	40.0
Lymphocytes (small)	22.0
Large mononuclear	27.5
Eosinophile	1.2
Basophile	0.5
Myelocytes	8.8
	100.0

Normoblasts, 2.
Megaloblasts, 2.

Aside from the few nucleated red cells the erythrocytes appeared normal in size, shape, color, and rouleau formation. In view of this fact and of the practically normal red-cell count and hæmoglobin percentage, the presence of normoblasts, megaloblasts, and myelocytes in blood which otherwise gave negative results could be accounted for only by an invasion of the blood-stream by these abnormal constituents from a disordered bone-marrow.

The suggestion was therefore made that the blood examination indicated an involvement of the bone marrow, due either to an inflammatory process or to the presence of a neoplasm.

The existence of decayed teeth suggested the possibility of a general sepsis originating in the mouth. A blood-culture taken October 25 gave no growth. A culture from a tooth-socket yielded staphylococcus pyogenes aureus, diplococci resembling the micrococcus lanceolatus, and some slender bacilli.

On October 26 the pain was so severe as to require morphine

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hypodermatically. It was now referred to both malar bones, both shoulders, and entire posterior chest, as well as to the previous regions in the lower trunk and extremities.

In the right axillary region the pain was particularly severe, especially on deep inspiration, and examination revealed slight dulness here, with a few pleuritic friction rubs. Both knees appeared slightly swollen, and the joints seemed to contain an excess of fluid, but aspiration of the left knee-joint found no effusion.

Leucocyte count, 13,000. Differential count, 300 leucocytes:

Polymorphonuclear neutrophile	24.3
Lymphocytes (small)	24.7
Large mononuclear	32.0
Eosinophile	2.0
Basophile	0.3
Myelocytes	16.7
	100.0

Normoblast, 1.
Megaloblasts, 8.

On October 27, epistaxis recurred. The temperature range was higher, to 101° F.; the pulse more rapid, 110; and the respiration continued at 30. Dulness, with diminished voice and breathing, developed at the right base.

October 28.—Temperature now continuous at about 102° F.; pulse 110 to 134, and more feeble; respiration 30 to 40. The distention and rigidity of the abdomen persist, and there is now some tenderness, especially marked on the right side. No masses made out. The patient looks much worse and is delirious at times. Requires morphine and whiskey.

Blood Examination.—Red cells, 4,296,009; leucocytes, 18,000. Differential count, 300 leucocytes:

Polymorphonuclear neutrophile	38.6
Lymphocytes (small)	21.7
Large mononuclear	19.8
Eosinophile	1.6
Basophile	0.3
Myelocytes	18.0
	100.0

Normoblasts, 2.
Megaloblasts, 6.

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The red cells otherwise are still normal in size, shape, color, and rouleau formation.

October 29.—Temperature, pulse, and respiration as before. Pulse becoming more feeble. Epistaxis recurred; delirium persists. Aspiration of right chest obtained about half an ounce of bloody serum. Microscopic examination showed many red cells, a few leucocytes, and a little fibrin.

Blood Examination.—Hæmoglobin, eighty-five per cent.; color index (red cells, 4,296,000), 0.98; leucocytes, 14,700. Differential count, 300 leucocytes:

Polymorphonuclear neutrophile	22.3
Lymphocytes (small)	32.0
Large mononuclear	31.3
Eosinophile	0.7
Basophile	0.7
Myelocytes	13.0
	100.0

The temperature rose steadily to 105.6° F., with increasingly rapid and feeble pulse, and death occurred on October 30, sixteen days after admission, and just three weeks from the onset of symptoms. On the last day a petechial eruption developed on the feet, in the popliteal spaces, and in the cubital fossæ and axillæ. A vesiculo-papular eruption appeared on the back. Profuse sweating had continued throughout since admission.

Autopsy, October 31, 1901, by Dr. Tuttle.—Heart negative, except for small red spots and petechiæ in the pericardium, and pale and flabby heart-muscle. *Left Lung:* One small white nodule at apex on pleura. Section congested and a little œdematous. *Right Lung:* The right pleural cavity contains 500 c.c. of blood-tinged serum. Scattered over the surface of the lung are numerous white patches—apparently thickening or new growth. These patches vary from small white dots to irregular streaks on the inner surface and base—usually about 1 mm. thick up to 3 to 4 mm. On section: upper lobe rather gray; lower lobe apparently compressed. *Diaphragm* greatly thickened; the right side being generally about $\frac{5}{8}$ inch thick, the left side showing one large area of equal thickness and another small nodule. On section, these areas are yellowish-pink in color. There are small irregular patches on both pleural and peritoneal

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coverings similar to those on surfaces of lungs. *Peritoneum:* The mesenteric glands are generally moderately enlarged. One mass of them is about 2½ inches in diameter by 1½ inches thick—and is hemorrhagic on section. Around this nodule there is some new growth in the mesenteric tissue. The omentum is much shrivelled up—but apparently not much thickened. There is a diffuse thickening of the peritoneum, especially on the right side and in the pelvic region, where it reaches a thickness of ⅝ inch, extending into the subperitoneal tissues. *Gall-bladder:* The wall is greatly thickened (in places to ¼ inch) and yellowish-white in color. Contains a little greenish bile. *Liver:* Surface shows a number of yellowish nodules varying in size from ¼ inch up to 2 inches in diameter. Some of them are slightly umbilicated. These nodules are yellowish-white on section and are irregularly distributed throughout the substance of the liver. *Spleen* negative except for a layer of new growth around the entrance of the blood-vessels at hilum. *Pancreas* almost entirely replaced by new growth resembling the form of the organ, but generally thickened. A small nodule at the tip shows the normal structure of pancreas. On section, pale. Running longitudinally through the head and part of the body of this growth is a brown infarct, whitish around edge, ⅜ inch in diameter and 2½ inches long. The color of the growth is yellowish-white on section, and lobular, while a portion of the tip of pancreas only is reddish on section. *Left Kidney:* Ureter and adrenal normal. The surface of kidney is smooth; shows little white nodules from the size of a pinhead to ¼ inch in diameter, very slightly projecting. On section, these nodules are seen dipping into the cortex for a short distance; one nodule only found entirely beneath surface. *Right Kidney:* Similar. Nodules more numerous on one side. *Stomach:* Mucous membrane is digested in places. There are seven or eight small nodules in the mucous membrane, ¼ to ½ inch in diameter. Several have a little ulceration in centre, making them look umbilicated. *Intestines:* There is one large nodule in jejunum about 5 feet below pylorus, 2 inches in diameter and ⅝ inch thick with an ulcerated depression in the centre. *Appendix vermiformis* is about 5½ inches long and ⅝ inch in diameter. The walls are greatly thickened and white. *Bladder:* The mucous membrane looks normal. The posterior wall of the organ is closely adherent to the thickened pelvic peritoneum. *Bones:* On the inner surface of the

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left ilium is a layer of new growth in and beneath the periosteum, at one point eroding the surface of the bone. The left femur is regular in outline. The marrow is yellowish-brown and of pasty consistence. *Brain* normal.

MICROSCOPIC EXAMINATION BY DR. THACHER.

The new growth in its various situations—in the retroperitoneal tissue, lymph nodes, mesentery, omentum; in the stomach, intestine, liver, kidneys, pancreas, diaphragm, lung and bone-marrow—

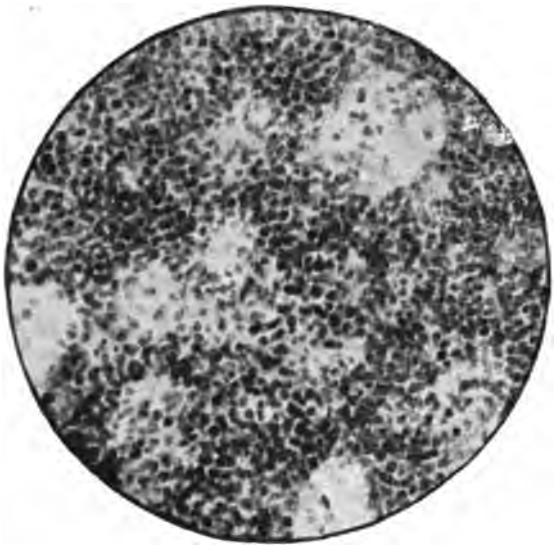

FIG. 1.—Section from marrow of left femur (× 200).

is found on microscopical examination to be essentially a growth of round cells. The cell-bodies are small, usually invisible. The nuclei are most of them round, some of them a little irregular in shape. In size they vary from that of lymphocytes to three or four times their diameter; the diameter of most of the nuclei being about two or three times that of lymphocytes.

The nuclei stain with the hæmatoxylin a little less deeply than do those of lymphocytes. The border is rather distinctly stained; the granules vary in size, but are somewhat less crowded than in lymphocytes.

Numerous mitotic figures are seen. In some parts the cells are

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partially or completely broken up. In the neoplastic tissue intercellular tissue is rarely to be made out, though here and there are little strands of fibrous connective tissue with elongated cells, and at rare intervals a blood-vessel.

In some of the organs (as intestine, appendix, and some parts of the adipose tissue) there is a diffuse infiltration, with separation of the elements of structure, but without distortion, and apparently without destruction.

In the sections of lymph-nodes which have been examined, most of the tissue appears to be neoplastic, with the larger cells, while a few small areas of the smaller lymphoid cells remain; but there is no sharp distinction between the two kinds of tissue.

The bone-marrow from the left femur consists of the new growth richly sprinkled with spaces which are evidently remains of fat-cells. (Fig. 1.)

A section from the intestinal nodule (Fig. 2) shows all layers densely infiltrated with the neoplastic cells, from the villi to the peritoneum. Cellular bands interlace with the muscular bands, and outside the muscle is a mass of new growth 6 mm. thick. The tips of the villi do not stain with the hæmatoxylin, and most of the epithelium in villi and crypts is gone.

In the appendix (Fig. 3) is a similar invasion of all the coats, but here the mucous and submucous coats are increased in thickness more than the others—the muscular coat least of all. The mucous and submucous coats together measure from 2 to 6 mm. in thickness. The subserous coat measures from ½ to 2 mm. in thickness. The strands of the muscular coat are much separated. The epithelium is almost entirely gone from the free surface, and the glands appear to be very few.

Sections from the nodules in the stomach show the mucous and submucous coats (especially in the superficial portions of the latter) and the subserous coat densely infiltrated with the new growth; but the muscular coat, for the most part, is free from invasion, though there is a little in some portions, mostly near the outer layers of muscle-fibre.

In the kidney (Fig. 4) the nodules of new growth are more sharply marked off from the tissues of the organ, as is also the case in the liver and lung. At the peripheries of these nodules, however, there is some mingling of the new growth and the original

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FIG. 2.—Section from nodule in jejunum.

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tissue in each of these organs. In the portal canals in the liver there are some rather diffuse accumulations of cells, resembling those of the new growth, together with some smaller cells (as if from simple inflammation), and some increase of the small bile-ducts.

The sections from the diaphragm consist mostly of new growth, with, in places, bundles of muscle-fibres much separated from one another by the cellular invasion.

The new growth was therefore a round-celled sarcoma, which had invaded most of the organs of the body, including the bone-marrow. This extensive involvement had given absolutely no symptoms until three weeks before death. As late as five days before death no clew whatever to the existing condition had been discovered until the blood-analysis indicated an involvement of the bone-marrow. Whether this was inflammatory or neoplastic in character could not be determined with certainty during the few remaining days of life; but the development of a hemorrhagic exudate in the right pleural cavity three days before death was certainly suggestive of new growth.

Aside from its importance from a diagnostic standpoint the blood-analysis is of interest from the fact that, in all counts after the first, megaloblasts were present in greater numbers than normoblasts. This megaloblastic type of blood suggests at once an analogy with pernicious anæmia, and is of great interest in connection with a case of pernicious anæmia reported by Grawitz in *Virchow's Archiv, Band 76*, page 353, in which at autopsy general sarcomatosis was found, with deposits in the bone-marrow. This case of Grawitz's has been considered indicative of a purely myelogenous origin of pernicious anæmia in some cases — from lesions interfering directly with the normal marrow activity.

Case II. Marked Eosinophilia due to the Ascaris Lumbricoides. —John B., aged seventeen, a West Indian negro, was admitted to the hospital November 20, 1901, in the service of Dr. Thompson. He had lived until six months ago on the island of St. Kitt's, West Indies, where swamps and mosquitoes abound and chills and fever are prevalent the year round.

Ever since he can remember, he has had yearly attacks of fever lasting from one to two weeks, with daily chilly sensations, but no distinct chills, followed by afternoon fever. These attacks have always been cured by decoctions of herbs.

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The present illness began like these previous attacks, twenty-four hours before admission, with creepy chilliness along spine and severe headache, followed by feverishness. The fever has continued ever since, and he complains also of soreness and pain in the muscles of the neck.

The temperature on admission was 103° F.; pulse, 112; respi-

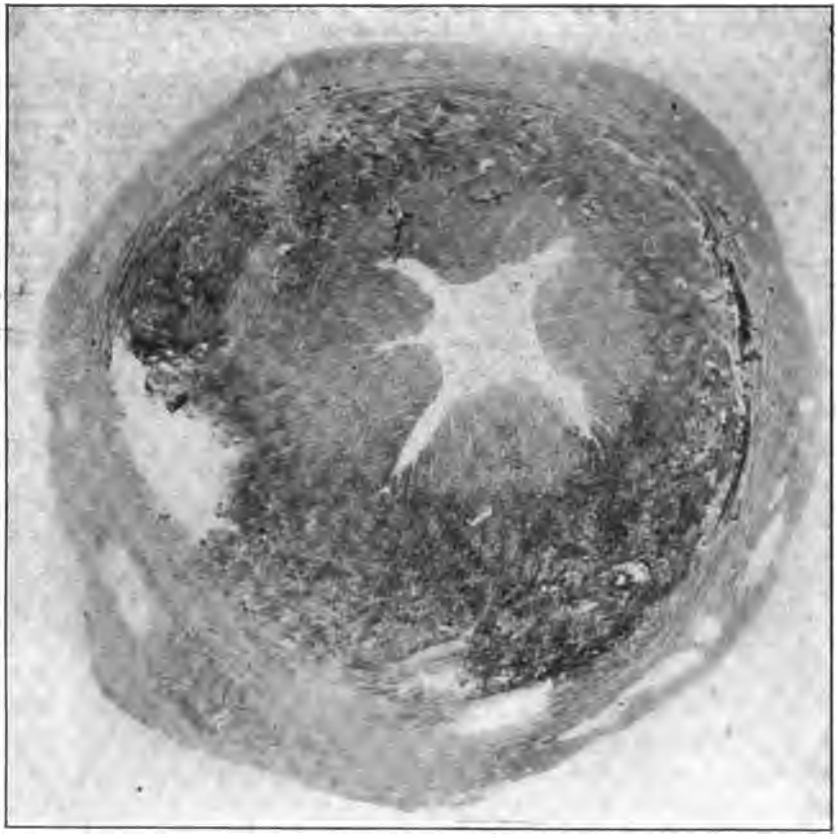

FIG. 3.—Section from vermiform appendix.

ration, 32. The physical examination was negative except for enlargement of the tonsils (which did not appear to be inflamed), a heavily coated tongue, and a soft systolic murmur over the pulmonic area.

The urine-examination was negative. On the day after ad-

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mission, while the temperature was 101° to 103° F., the blood was examined for malarial organisms, but none were found. The leucocyte count was 7,000.

Slight headache and nocturnal restlessness were the only symptoms present after the first day, and these disappeared on the third day, when the temperature fell to normal, where it remained.

The differential leucocyte counts, made on four different days, were as follows:

	Nov. 21. 300 cells.	Nov. 22. 100 cells.	Nov. 23. 400 cells.	Nov. 25. 400 cells.
Polymorphonuclear neutrophile	53.0	45.0	33.2	46.2
Lymphocytes (small)	6 0	8.0	20.3	20.8
Large mononuclear	7 0	15.0	23.2	13.7
Basophile	0.4	1.0	0.5	0.0
Eosinophile	33.6	31.0	22.8	19.3
	100.0	100.0	100.0	100.0

The red blood-cells appeared normal, except for slight pallor of centres.

The blood was searched at night for the filaria sanguinis hominis but none were found.

Fæces, examined November 25, showed large numbers of ova of ascaris lumbricoides and of tricocephalus dispar.

Santonin was given, but the patient refused to remain in the hospital long enough for the effect of treatment on the eosinophilia to be determined.

The highest percentage of eosinophile leucocytes reported in cases of ascarides is given by Bücklers (*Münch. Med. Woch.*, 1894, p. 22), who found nineteen per cent. in one of his cases. The eosinophilia in our case (thirty-three per cent.) is, therefore, the highest yet recorded.

Case III. Pernicious Anœmia showing a Normoblastic Crisis and associated with the presence of Ascaris Lumbricoides.—C. W. K., aged forty; was admitted to the hospital, November 29, 1901, in the service of Dr. Kinnicutt.

Family History.—Negative.

Personal History.—Habits good. Uses very little alcohol and no tobacco. No venereal history. Had the ordinary diseases of

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	Dec. 31.	Jan. 6.	Jan. 13.
Numbe	500	500	500
Polyme	43.0	61.2	57.0
Large	10.8	13.4	10.2
Lymph	39.6	19.8	27.2
Eosino	1.4	2.4	2.8
Basoph	1.6	1.2	1.2
Myeloc	3.6	2.0	1.6
	100.0	100.0	100.0

Normo	26 = 5.2 p. c.	13 = 2.6 p. c.	9 = 1.8 p. c.
Megal	34 = 6.8 p. c.	10 = 2.0 p. c.	11 = 2 2 p. c.
	60 = 12.0 p. c.	23 = 4.6 p. c.	20 = 4.0 p. c.
Leucoc	440 = 88.0 p. c.	477 = 95.4 p. c.	480 = 96.0 p. c.
	500 = 100 p. c.	500 = 100 p. c.	500 = 100 p. c.
Total	5,900	7,000	8,300
Estim	5,192	6,678	7,970
Estim	306	182	150
Estim	402	140	180
Estim	708	322	330
Red c	1,720,000 1,672,000	2,172,000 2,016,000	2,250,000
Hæmo	.....	60 p. c.	65 p. c.
Color	.....	1.5	1.44

with anorexia and constipation.

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no venereal history. Had the ordinary diseases of

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childhood; typhoid at ten years of age; had malaria twelve years ago; attack lasted five days. Never had jaundice before.

Present Illness began four months ago. He remembers having felt rather languid and listless for several weeks before he became ill—but this was during the heat of summer, and he had been gaining steadily in weight until just before the present illness, when he

FIG. 4.—Section from kidney.

weighed more than ever before—169 pounds. He had been neither weak nor pale at any time before August 1, 1901. At about this time he was suddenly seized with severe abdominal pain, cramp-like in character, which lasted for three days with but slight intermission. The pain then subsided, but he felt weak and was troubled with anorexia and constipation.

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About one week after the onset of his illness he noticed that his skin had become yellow, the urine was dark colored, and the stools light yellowish, not chalky. A purgative cleared up the urine somewhat and darkened the stools; but the former conditions soon returned and have persisted for over three months. The jaundice steadily deepened to a pronounced lemon-yellow hue, which has continued ever since.

With the onset of the jaundice he began to have pain in the right hypochondrium, a heavy dull ache, with occasional attacks of a sharp, shooting character. A sharp, stabbing pain was also present at times in the left hypochondrium. There was no localized tenderness noticeable, and the pain was not increased on motion.

These pains continued persistently until one month ago, when the acute attacks ceased; but the dull aching in the right side is still constant. He has never suffered from headache or hæmorrhoids. For two months past anorexia has been pronounced, with occasional vomiting of food and thick mucus, but no blood. There has been a dry, irritable cough, which sometimes excites the vomiting. Flatulence marked during this time. Occasional pruritus.

He has grown progressively paler and weaker, until now he has faintness, dyspnœa, and nausea on the slightest exertion. The feet are constantly cold. He has lost nearly twenty pounds in weight. He feels feverish, but has had no chill. He complains of a constant bad taste in the mouth.

The chief complaints are the prostration, anorexia, and the dull pain in the right hypochondrium.

Physical Examination.—Patient fairly well nourished, of large frame. Skin shows a rather intense lemon-yellow hue. Conjunctivæ markedly icteroid. Mucous membranes very pale. Tongue pale, inclined to dryness; heavily coated with whitish fur. Pharynx and tonsils look normal, except for marked pallor. Teeth well cared for; none carious. *Lungs* negative. *Heart:* Apex impulse in fourth space 3¼ inches from mid-sternal line. Cardiac dulness corresponds. No murmurs heard over mitral area. Faint systolic murmur over pulmonic area. Heart sounds rather faint. *Superficial glands* negative. *Extremities* negative. No œdema. *Liver:* Upper limit of dulness at 6th rib. Edge palpable one inch below costal margin in mammillary line, and in median line about two inches below ensiform. Edge sharp. Surface of liver seems smooth.

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Spleen palpable about two inches below costal arch in mammillary line, on deep inspiration. *Abdomen:* There is some sensitiveness on deep palpation just below costal arch on right side, also over palpable portion of spleen. Abdomen is perhaps a little full, with considerable adipose in wall. Tympany increased a little in upper half. No signs of fluid; no masses. *Pulse* full. Vessel empty between beats. Has somewhat the character of aortic insufficiency.

Course in Hospital: There was an irregular febrile movement for three days after admission, with an afternoon rise of temperature to 101° to 102° F., and on the third day to 104°. The pulse ranged from 80 to 104. After this there was a slight irregular elevation of temperature, usually in the afternoon, reaching 100° to 101° F. This has continued throughout. The pulse has varied between 80 and 100.

During the first two weeks the chief complaints were anorexia, nausea, and extreme weakness, occasional epigastric pain, and some dizziness at times.

A test meal was given on the day after admission, and no free hydrochloric acid was present in the gastric contents.

The blood examination on the day after admission showed: Red cells, 520,000; hæmoglobin, 25 per cent.; color index, 2.5; leucocytes, 17,000.

The average of two differential counts, taken a few hours apart, aggregating 350 leucocytes, was as follows:

Polymorphonuclear neutrophile	54.0
Lymphocytes (small)	25.0
Large mononuclear	16.5
Basophile	0.3
Eosinophile	1.7
Myelocytes	2.5
	100.0

Normoblasts	325
Megaloblasts	146
Total nucleated red cells seen in counting, 350 leucocytes	471

Poikilocytosis and polychromatophilia very pronounced. Rouleau formation absent. By far the greater number of the red cells were much larger than normal (megalocytes) and these cells showed

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marked variations in staining properties, some dark, some light, and many exhibited basophilic granules with Jenner's stain (granular degeneration). As a rule, the smaller red cells showed a deeper staining. Microcytes were fairly numerous.

The most remarkable feature of the blood-picture was the enormous number of nucleated red cells, from eight to twelve or more being found in a single field with a one-twelfth oil immersion lens. (The calculation of the total numbers of normoblasts and megalo-

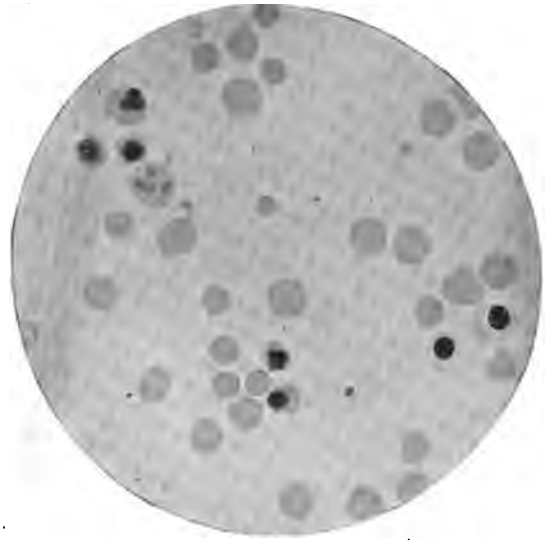

FIG. 5.—Nucleated red cells (× 500).

blasts per cubic millimetre of blood at the different examinations will be found in the tabulated blood-analysis.)

The total number of nucleated red cells per cubic millimetre was estimated to be about 32,000 on one day, and 35,000 three days afterward.

The largest number of nucleated red cells recorded in Ewing's exhaustive search of the literature, in his book on "The Clinical Pathology of the Blood," is 6,000 per cubic millimetre.

The normoblasts showed all varieties of pyknomorphous nuclei.

The megaloblasts exhibited all degrees of protoplasmic and nuclear changes: granular degeneration, polychromatophilia, and "notched" peripheries of the protoplasm, and nuclei in the "rest-

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ing stage," mitosis, and karyorhexis (Figs. 5 and 6). The blood was searched for malarial organisms, but none were found.

A second test-meal, consisting of steak, bread, and tea, yielded gastric contents which showed an acid reaction to litmus-paper, but no free HCl. The total acidity was 0.394 per cent. Lactic and butyric acids were present.

The *stools* for some days after admission were fluid, tarry, and contained red blood-cells in considerable numbers, with much dark granular material looking like blood pigment. A moderate number of leucocytes were present, and ova of Ascaris lumbricoides were discovered. After the administration of santonin, a single female ascaris was passed. The stools showed an occasional ovum afterward for a few days, after which no more appeared.

No other ascarides were passed, although santonin was given repeatedly.

After the second week the red cells and pigment disappeared from the stools, which then lost their tarry appearance, became normal in color, and were semi-solid or formed.

The *urine* during the first week showed a specific gravity of 1014 to 1018, was dark reddish-brown in color, and contained from three to seven per cent. of albumin.

The red flocculent sediment contained many granular and epithelial casts, which were stained deep yellow or brown, a few leucocytes and red cells. Traces of bile-pigment and of hæmoglobin were present, but no pathological urobilin could be detected by von Jaksch's test.

Indican, which was absent at first, appeared in considerable amount during the second week and then disappeared gradually. Uric-acid crystals were present in great numbers while the urine remained dark colored and showed the presence of indican; but after the second week, the color of the urine became amber, the turbidity cleared up, and the albumin, casts, bile, hæmoglobin, and red cells disappeared except for a very slight reaction for albumin and an occasional cast.

The specific gravity has varied from 1008 to 1024. No glucose was present at any time.

On December 9, while the urine was still dark and turbid, an analysis of the total quantity excreted in twenty-four hours gave the following result:

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Quantity in twenty-four hours	1,245 c.c.
Specific gravity	1011
Reaction	Acid
Appearance	Reddish-brown, turbid
Albumin	Light trace
Indican	Considerable
Glucose	None
Hæmoglobin (Mahomed's test)	Present
Casts	Many granular
Cells	Very few red; few leucocytes
Iron	Present in considerable amount

Quantitative Analysis (per cent.).

		Normal.
Acidity	0.12	0.03– 0.08
(Equals 0.157 gm. oxalic acid in total)		0.50– 0.90
Urea	17.33	25.00–35.00
Uric acid	0.553	0.50– 0.75
Ratio	1 to 31	1 to 45—55
Sulphates preformed	1.13	2.5 –03.00
Sulphates combined	0.209	0.2 – 0.25
Ratio	1 to 5	1 to 10—16
Chlorides	4.72	6.0 –14.00
Phosphates	1.58	1.5 –03.00
Total nitrogen	8.09	12.0 –18.00
Per cent. nitrogen of urea	82.54	85.0 –90.00
" " " uric acid	2.27	2
" " " ammonia	2.71	2.0 –05.00
" " " extractives	12.48	5.0 –10.00

The medication employed was strychnine, arsenic in ascending doses, and iron with pepsin and HCl after meals.

The improvement in the condition of the blood is shown in the accompanying table, in which all the blood examinations have been recorded.

In counting the leucocytes, using the Thoma-Zeiss apparatus, and diluting the blood with a 0.5 per cent. solution of acetic acid, it was, of course, impossible to exclude the nucleated red cells. The count of the total nucleated cells was, therefore, made in this manner, and the relative proportions of leucocytes and nucleated red cells were afterward calculated from the results of a differential count of 500 nucleated cells in a stained smear. The percentages and total numbers of each variety per cubic millimetre are given in the table.

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With the improvement in the blood condition the patient's general health rapidly changed for the better. The pain, anorexia, nausea, and vertigo disappeared, and he gained in appetite, strength, and color, and on January 7 began to sit up. That this is a case of pernicious anæmia seems indubitable from the high color-index, the very large proportion of megalocytes, the existence of megalo-

FIG. 6.—Gigantoblast in mitosis—also megaloblast with vesicular nucleus and normoblast with "rosette" nucleus (× 1000).

blasts in pathological mitosis, and, finally, the fact that after the normoblastic crisis had ceased megaloblasts appeared in excess of the normoblasts.

The normoblastic crisis was most extraordinary. Occurring in connection with a leucocytosis (as will be seen by reference to the figures in the table under the dates from December 1 to December 9), it corresponds in all essential particulars with the only similar case reported in the literature on the subject. This is the case described by Dorn in his thesis "Blutuntersuchungen bei perniciöser Anaemie," published in Berlin in 1891. The patient apparently made a rapid recovery under treatment by arsenic. Dorn also reports another case in which normoblastic crises with leucocytosis accompanied several periods of temporary improvement, but which eventu-

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ally terminated fatally. He concludes that such blood crises, accompanied by leucocytosis, are of favorable prognostic import. This conclusion certainly seems to be supported by the outcome in our case.

The presence of the Ascaris lumbricoides in this patient is certainly interesting, although its etiological significance must remain at present extremely doubtful. Two cases of fatal anæmia in children, associated with the occurrence of this parasite in the intestine, have been reported by Demme (Grawitz, "Klin. Patholog. d. Blutes," 1896, p. 310), but it hardly seems possible that the presence of a single worm in an adult could produce such profound anæmia as existed in this patient. The suggestion presents itself that other ascarides may have lived in his intestine and died there, and that the anæmia resulted from the absorption of the decomposed worms. This is the view taken by Ehrlich in reference to certain cases of Bothriocephalus anæmia.*

In the same connection, Ehrlich states that "As in many infectious diseases, individuals react quite differently to the presence of the Bothriocephalus. Some remain well, others show the signs of simple anæmia ultimately with normoblasts, while a third group presents the typical picture of pernicious anæmia." †

Our present knowledge of these conditions is so imperfect, however, that no conclusion as to the rôle played by the ascaris in this instance is justifiable. Possibly the future history of the case may throw some light on the subject.

(NOTE.—March 14. Since the last recorded blood examination on January 13, the condition has shown little change. The red blood-cells now number 2,500,000, an increase of only 250,000 in two months. Hæmoglobin varies between 50 and 60 per cent. The megaloblasts are now constantly in excess of the normoblasts, and the total number of nucleated cells per cubic millimetre remains about the same as at the last counts recorded in the table.

No more ova have been found in the stools.

The case therefore appears to be a typical pernicious anæmia—and the presence of the Ascaris lumbricoides was probably mere coincidence.)

* See Ewing: Clinical Pathology of the Blood, p. 177.

† Histology of the Blood (translated by Myers), p. 65.

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XIV.

REPORT OF A CASE OF TUMOR OF THE CAUDA EQUINA, WITH SUCCESSFUL OPERATION FOR REMOVAL. RECURRENCE. DEATH.

By M. A. Starr, M.D., LL.D., and A. J. McCosh, M.D.

Tumors of the spinal cord and cauda equina are of sufficient rarity to warrant the report of cases where the diagnosis has been made and confirmed either by operation or by autopsy. Five years ago I was able to collect 145 cases from the literature of the subject, in 22 of which an operation had been undertaken. Numerous cases of spinal tumor have been reported since that time, but operations during the past five years for the removal of spinal tumor have not been more successful than in the previous decade, nor have they been very numerous, there being but twelve cases reported since 1895.

In the following case the symptom of pain, as in almost all cases of spinal tumor, was very prominent, and, in combination with the symptoms of pressure upon the cauda equina, enabled a diagnosis to be reached. Furthermore, the situation of the pain afforded a definite indication of the situation of the tumor.

Pain over the Left Hip, Numbness and Paralysis of the Left Leg below the Knee, Anæsthesia, Operation, Removal of a Sarcoma Involving the 3d and 4th Lumbar Vertebræ.

Mrs. K., aged forty-six, was in good health until May, 1900, when, after a slight injury, she was delivered of a dead child. Soon after this confinement she began to suffer from intense pain in the left hip, which pain extended backward over the sacrum and occasionally down the outer side of the thigh nearly to the knee. This pain caused sleeplessness and a progressive failure of health, and resisted all forms of treatment. In September, while the pain continued, she began to notice a numbness of the left foot and a progressive weakness of the left leg with drop-foot, and at the same time some

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difficulty in the control of the sphincters. She was admitted to the Presbyterian Hospital on October 16, when the following condition was found :

She was a rather pale, weak, feeble woman and appeared to be suffering greatly from paroxysms of pain, which she located over the left side of the sacrum and over the left trochanter, the pain at times extending down the outer side of the left thigh and leg. She was able to flex and extend her thigh and knee, but there was a drop-foot due to paralysis of the peronei and anterior tibial muscles. The left knee-jerk was absent. There was difficulty of micturition, which required catheterization, and the rectum had to be emptied by enema. She complained of numbness in the foot, and careful examination showed a region of anæsthesia, as shown in the diagram (Figs. 1 and 2.), extending down the back of the left thigh and leg, and over the anterior side of the left foot, also upon the back of the right thigh to a much less extent ; the anus and perineum were also anæsthetic. It being uncertain whether any specific disease had existed, she was placed upon inunctions of mercury and iodide of potash internally, but three weeks vigorous treatment in this manner failed to produce any result. During this time the pains were intensified, the paroxysms of pain being more frequent and the pain extended so that it involved the entire left leg, excepting the front of the thigh. During this time paralysis appeared in the right foot involving the peronei and anterior tibial muscles so that the foot dropped. Paralysis increased in the left foot involving the posterior tibial group of muscles, so that all motion of the ankle and toes was impossible. Careful examination of the back showed an area of tenderness to pressure over 2d, 3d, and 4th lumbar vertebræ, and pressure in this region increased the pain in the left hip. The area of anæsthesia remained constant, the anæsthesia to pain and temperature being much more marked than it was to touch. The knee-jerk on the right side was lost after she came to the hospital.

Diagnosis.—In view of these facts it seemed probable that a tumor was present pressing upon the cauda equina and extending as high as the level of exit of the 2d lumbar nerve. Pressure upon the cauda is known to cause a suspension of function of those nerves lying in the centre of the cauda, rather than those upon the surface, and it was evident from the symptoms that the function of all the

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sacral nerves and of the last lumbar nerve was affected on the left side and the function of the four lower sacral on the right side. The existence of pain, however, in the region of the 2d lumbar nerve was an evidence that the pressure was exerted at least as high as the 2d lumbar vertebra. The diagnosis of a cauda lesion rather than a lesion in the cord itself was reached, because of the level of the pain. The cord, as is well known, ends at the first lumbar vertebra, and any lesion of the cord itself sufficiently extensive to destroy the

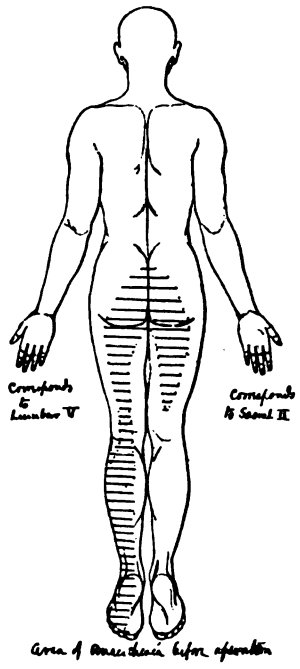

FIG. 1.

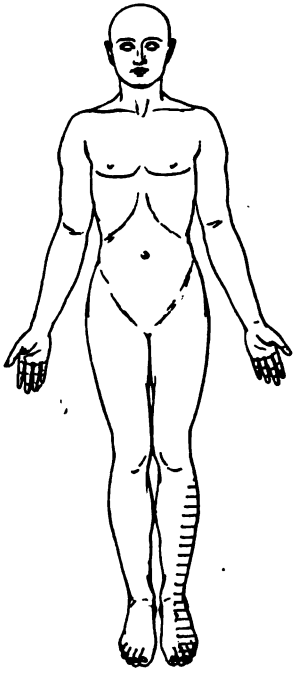

FIG. 2.

sacral segments and to involve the lumbar enlargement sufficiently high to produce pain in the distribution of the 2d lumbar nerve would necessarily destroy the lumbar enlargement, and hence produce a much greater region of anæsthesia and an extensive paralysis of both thighs and legs. The functions of the cord were not impaired above the level of the 5th lumbar segment, but the pain was referred to the region of the 2d lumbar nerve. No single lesion

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could produce this combination of symptoms with integrity of function of the 2d, 3d, 4th, and 5th lumbar nerves, excepting a tumor pressing on the cauda equina. The level of pain was taken as an indication of the upper level of such a tumor, and hence it was determined to operate at the level of the 2d lumbar nerve.

On November 15, Dr. McCosh operated, removing the spines and arches of the 2d, 3d, and 4th lumbar vertebræ. Though there was no indication upon the skin of the existence of any tumor, as soon as the integument was divided it was evident that the muscles were infiltrated by a neoplasm, and further dissection showed a tumor involving the soft as well as the hard tissues of this region. The spines and arches of the vertebræ had been eroded and the muscles above them quite infiltrated by a tumor, which subsequent microscopical examination proved to be an endothelioma. This tumor tissue had invaded the spinal canal and had produced pressure upon the dura. A considerable mass was removed in small pieces as high as the upper level of the 2d lumbar vertebra, above which the tissues appeared fairly normal. The patient did not stand the operation very well, and for the subsequent two days was in a critical condition, but survived, and two weeks later was extremely comfortable. She had had no pain since the day of the operation, the area of anæsthesia upon the back of the legs had diminished progressively in size, and on November 30 corresponded to Diagram No. 3. The motion of her legs and thighs was more free, but the drop-foot continued upon both sides and a considerable degree of atrophy developed in both peronei and in the anterior tibial group upon the left leg. The wound healed perfectly and showed no evidence of further malignant growth, and it was hoped that the removal of the pressure would result in eventual recovery. But in the course of the

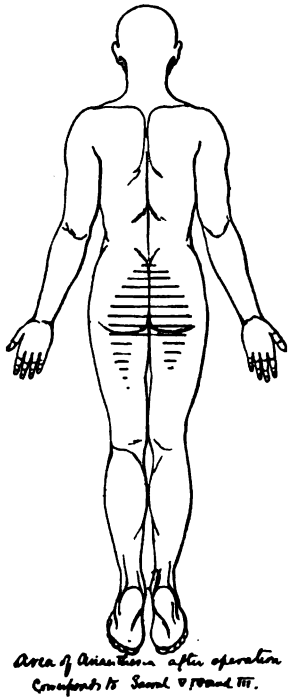

FIG. 3.

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following month her symptoms gradually returned, her pain became severe, her paralysis and anæsthesia became more intense, and she gradually failed in strength. In view of the extensive infiltration of the tissues found at the operation and their great vascularity, no further operation was thought proper. She was discharged from the hospital on January 20, and died soon after in her home. No autopsy was permitted.

In this case the operation was done promptly; and since paralysis from pressure on the nerves of the cauda disappears in time, as regeneration of those nerves is possible, we hoped for recovery. The nature of the tumor was such as to favor a recurrence, but the wound of the operation had healed promptly, and it was thought that a recurrence might be delayed for a considerable time. The result, however, was such as often occurs in malignant cases.

NOTE.—Within the last two years there have been in this hospital two other operations performed for tumors of the cauda equina. These cases have been reported by Dr. McCosh, in the *Journal of the American Medical Association* for August 31, 1901. One of these cases, operated on May 22, 1900, a sarcoma being successfully removed, is at the present time (April, 1902) in perfect health. In another similar case, at the end of a few months the tumor returned, and the patient died in seven months.—EDITORS.

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XV.

A CASE OF GANGRENE OF THE SMALL INTESTINE, DUE TO HÆMATOMA IN MESENTERY, AS A RESULT OF CONTUSION OF ABDOMEN.

By Andrew J. McCosh, M.D.

J. C., aged ten, on May 19, 1892, fell from a fifth-story window to the ground, alighting across his abdomen on an iron bar. For a short time he remained unconscious, but soon recovered. Though weak and listless there was no special complaint till the evening of the next day. He had, however, vomited once or twice soon after the injury. His urine was clear. On the evening of May 20, he was brought to the hospital by ambulance. He was suffering from a slight degree of shock. His mind was clear and he seemed comparatively comfortable. His temperature was 100½° F.; his pulse, 124, feeble; and respiration, 42. On the following day he was more restless and complained occasionally of sharp abdominal pain. He had vomited twice during the night. His temperature was 99⅓° F.; pulse, 120; respiration, 34. The evening temperature was 100¾° F. Laceration or severe injury of one of the abdominal organs was suspected, and operation advised. Consent, however, could not be obtained.

On May 22, the pulse was more feeble and there was some local tenderness to pressure in the left hypogastric region. The symptoms indicated still more strongly some grave intestinal injury; operation was urged and finally accepted. Under chloroform anæsthesia, the abdomen was opened in the median line above the umbilicus. A blackish coil of intestine immediately came into view, completely gangrenous for a distance of fifteen inches. It was apparently part of the jejunum. Opposite the gangrenous portion, there was situated between the layers of the mesentery a large blood-clot, reaching well back to the mesenteric origin, and extending outward from this point, fan-like, till at the intestinal wall it

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measured about ten inches in breadth. The clot varied in thickness from one to three inches. The gangrenous portion of intestine was excised and the ends united by suture. The boy's condition was very bad; he failed to rally from shock, and died in six hours.

In reviewing this rather unusual case, some points of interest claim attention.

First, as regards the boy's symptoms. With the exception of some vomiting immediately after the injury, there were no symptoms for at least thirty-six hours pointing to grave abdominal injury. There was no complaint of pain, and while the pulse was rapid and feeble, it was not more so than could be explained by mere shock from a fall from the fifth story of a house. When he arrived at the hospital, about thirty hours after the receipt of the injury, the amount of shock was not great. The rapidity of his respiration (42), however, was somewhat significant. On the next day (48 hours after injury) the temperature was still but little above normal; the pulse, while no more rapid, was somewhat feebler, restlessness was more marked, sharp abdominal pain was complained of, and also some tenderness to pressure and muscular rigidity in the left side of the abdomen.

The diagnosis was uncertain, but the general appearance of the boy, when considered with his history, pointed to some grave intra-abdominal lesion. The symptoms did not correspond with those which one expects when there has been some severe intra-peritoneal hemorrhage. He did not appear blanched, nor had the signs of shock been marked. There had been no air-hunger or excessive thirst. The restlessness did not appear until thirty-six hours had elapsed. The conditions found at operation corresponded with those symptoms or rather lack of symptoms. The blood-clot in the mesentery represented, probably, about ten or twelve ounces of blood, and none had escaped into the general peritoneal cavity. Laceration of the liver or spleen was not considered probable, on account of the absence of severe shock. The urine was free from blood, neither was there any mass to be felt in the region of the kidney. Intestinal laceration with perforation was considered, but the symptoms did not point toward a general peritonitis. Distention was not marked, neither was vomiting. The most probable diagnosis seemed to be a moderate hemorrhage with some local peritonitis. Gangrene of the intestine had not been considered.

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There were no symptoms specially pointing to this condition. Indeed, the signs of such a lesion are apt to be very indefinite. The temperature record is of no special value. It may be subnormal or moderately elevated. The pulse, as in other severe intra-peritoneal injuries, is generally rapid and of very poor quality. Abdominal distention, at least before peritonitis complicates the case, is not a prominent symptom.

J. N. Elliot* collected fifty cases of gangrene of the intestine due to plugging of the mesenteric artery or vein. The history of these must, of course, at the beginning, be different on account of the character of the onset. The subsequent history should, however, be more or less similar. In these, pain, often colicky, was the most prominent symptom, but the sudden plugging of the vessel, without other concomitant injuries or lesions, would naturally in this class of cases make this feature more noticeable. In cases such as the one just reported, the concomitant nervous shock and consequent benumbing of sensibility would be apt to render pain more or less insignificant. The next most prominent symptom in Dr. Elliot's cases was vomiting. This, while present in our case, was not severe. Blood in the stools was also a symptom which occurred in the majority of the cases where the blood-vessel had become occluded; also, in a smaller proportion of these cases, blood was vomited. Both symptoms were absent in our case. In one case reported by Dr. Elliot, the hæmatoma in the mesentery was felt as a tumor before operation.

J. T. Bottomley† has carefully analyzed 40 cases of severe abdominal contusion. In 20 of these a severe intestinal injury was present; in 20, who recovered without operation, the conclusion was formed that there had been no visceral lesion of importance. After reading his discussion of the various symptoms in each class of cases, one cannot fail to be impressed by the difficulty in determining whether they be due to a mere contusion or to a visceral injury. He concludes that the combination of symptoms does not aid any more in the diagnosis than do the individual symptoms.

Second, as regards treatment: If the diagnosis of intestinal gangrene can be made, operation is, of course, urgently demanded. If we could feel positive—which probably we never can—that a large

* Annals of Surgery, vol. 21, p. 79.

† Medical and Surgical Report of Boston City Hospital, vol. xii.

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hæmatoma was present and was confined between the layers of the mesentery, immediate laparotomy would be indicated. It is true that the mesenteric artery has been found completely obliterated without gangrene having resulted, but in such cases the plugging of the vessel has probably taken place slowly, thus giving time for the collateral circulation to become established. In the case just reported, the hæmatoma was so extensive that gangrene of a considerable portion of the intestine was bound to result. Had the boy's parents consented to an operation at the end of forty-eight hours, when it was advised, his chances for recovery would have been good. But the additional delay of twenty hours was sufficient to place the boy in a condition from which he could not rally.

As already stated, we can rarely feel positive concerning the nature of the lesion in cases of severe abdominal injury. The shock of a mere contusion may be great, and on the other hand, the shock, due to laceration of the intestinal wall, is not always great. Reference has already been made to the unreliability of other symptoms, such as pain, temperature, pulse, tympanites, muscular rigidity, etc., as a means of differentiating between cases of simple abdominal contusion and those in which there is, in addition, grave intestinal injury. In brief, the diagnosis of the extent of the injury can often not be made. Long delay in this class of cases is dangerous: laparotomy, necessarily in a large measure exploratory, is indicated.

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XVI.

A RARE CASE OF INTESTINAL OBSTRUCTION.

By E. Eliot, Jr., M.D.

A. M., aged eighty-two. Patient has always been robust and has usually enjoyed good health. She has had seven children. After one of her last pregnancies, some forty years ago, she first noticed a small swelling at the umbilicus, having the characteristics of a reducible hernia. This failed to cause any discomfort until about ten years ago, when it became partially irreducible, and occasioned from time to time dull aching pains, which disappeared after the application of an abdominal support.

One year ago patient developed the symptoms of gall-stone, the associated jaundice extending over a period of six weeks and accompanied by occasional attacks of colic. The symptoms disappeared, however, after the usual treatment.

The present illness began eighteen hours before the admission of the patient to the hospital, with an attack of severe epigastric pain and with persistent vomiting. The hernia, previously partially reducible, increased in size, became tender, and could not be returned into the abdominal cavity. An examination by Dr. Victoria, several hours later, revealed the usual local symptoms of a strangulated hernia. On account of the patient's advanced age, attempts were made to reduce the hernia by moderate pressure and by the application of hot fomentations. At the same time a high oil enema failed to produce any action of the bowels, even of the passage of flatus. All local measures proving ineffectual, the patient was referred to the hospital for operation. During the trip to the hospital, the jolting of the ambulance over a rough cobble pavement brought about a sudden marked diminution in the size of the hernia, and it was found by examination shortly after reaching the hospital that the hernia had lost all elasticity, and that the impulse had returned. The sac seemed to contain a mass of omentum of moderate size, irreducible and lacking tenderness.

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It was hoped that the reduction thus opportunely effected would be followed by a subsidence of the constitutional symptoms of obstruction, thus obviating the necessity for operative interference. With this end in view, lavage was administered, and the patient was given a stimulating turpentine enema. The vomiting, however, persisted and assumed a fecal type. There was also no abatement of the abdominal pain. The solid contents of the colon were brought away by the enema, without, however, the escape of any flatus.

The patient's general condition was excellent, the pulse varying between 92 and 104, the temperature between 99° and 100° F., and the respiration between 22 and 34.

The examination of the abdomen, apart from that of the hernial swelling, showed the presence of some slight rigidity on either side of the umbilicus, but, owing to the great corpulency of the patient, nothing further of an abnormal nature could be determined. Under such circumstances, the persistence of the obstructive symptoms, notwithstanding the disappearance of the local evidences of strangulation, undoubtedly justified operative interference.

Under chloroform anæsthesia, an incision made in the median line both above and below the umbilical hernia was gradually deepened through the linea alba into the peritoneal cavity. After the protection of the region of the mouth of the sac by the introduction of pads above and below, the cavity of the sac was exposed by joining the extremities of the original incisions. The sac was found to contain a small amount of clear fluid with a mass of omentum firmly adherent to its serous wall. This was ligatured with ordinary catgut and removed. After removal of the sac itself, the edges of the abdominal incision were retracted in an effort to find the cause of the obstruction. Several dilated and congested loops of small intestine immediately presented, with their walls covered in places by a fresh fibrinous exudate. These were gently withdrawn, following the line of increasing congestion and dilatation, resulting shortly in the exposure of a loop of gut which, on palpation, was found to contain a rounded hard body, completely filling its lumen. Below this point the small intestine presented a collapsed appearance. After proper protection of the affected loop with pads, and the removal by gentle pressure of the enterolith into a normal adjacent segment, the lumen of the intestine was exposed by a longitudinal incision along its outer convex margin, and the enterolith removed.

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The incision in the intestine was then closed by two rows of sutures: an inner, continuous, of catgut passing through all coats; and an outer, interrupted, of fine silk of the usual Lembert type. The congested intestine was washed with a hot saline solution, and, after the insertion of a drain of iodoform gauze through the lower angle into the peritoneal cavity, the edges of the wound were approximated by a row of interrupted sutures of silk-worm gut. Usual dressing of sterile gauze and abdominal binder.

The enterolith was lamellated in structure, the central nucleus being a gall-stone. While one extremity was smooth and rounded, the other presented a fractured surface, the enterolith being evidently about four-fifths of its original size. Nothing was seen or felt of this other fragment, either at the time of operation or subsequently in the stool. Possibly it may have been discharged through the bowel before the onset of the obstruction.

The patient stood the operation, about forty-five minutes in length, very well. There was no evidence of shock, and at no time did the patient's pulse exceed 100. The drain was removed at the end of the fifth day. Subsequently the convalescence was uninterrupted, with the exception of slight suppuration in the superficial portion of the wound, between the aponeurosis and the skin. The wound had entirely closed by the fifth week after the operation.

At no time before the discovery of the enterolith, in the course of the operation, was its presence suspected as the cause of the obstruction. This is accounted for by the fact that the previous history of the case was obtained through an interpreter during convalescence, the patient being an Italian, without any knowledge of English. The case, prior to admission to the hospital, was undoubtedly one of strangulated umbilical hernia, and, before the diminution in the size of the mass, the sac probably contained the loop of small intestine in which the enterolith was situated. The jolting of the ambulance, together with the weight of the stone, brought about the return of the loop into the abdominal cavity.

The persistence of the vomiting and the abdominal pain after the apparent reduction of the hernia was thought, prior to the operation, to be due to one of several conditions:

(*a*) "Reduction en masse." This was considered unlikely, inasmuch as the decrease in the size of the hernia had occurred as the result of the jolting of the ambulance and had not been brought

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about by any undue effort of taxis, which is commonly regarded as the sole cause of this condition.

(*b*) Necrosis of the strangulated loop of gut could also have accounted for the persistence of the symptoms of obstruction after the disappearance of the hernia. Spontaneous reduction of necrotic intestine must be very rare, however, owing to the loss of peristaltic power of the affected loop, as well as to the fact that reduction by gravity is rendered difficult by the presence of fresh fibrinous adhesions at the point of constriction. This condition was also considered improbable, because of the persistence of pain, a symptom which in the absence of a complicating peritonitis either totally disappears or is greatly diminished when necrosis of the contents of the sac takes place.

(*c*) A paralysis of the peristaltic activity of the wall of the gut was considered to be the most probable cause of the persistence of the symptoms of obstruction. This would readily be accounted for by the advanced age of the patient, and would also be favored by the sharp character of the constriction, as indicated by the early and frequently repeated attacks of vomiting, as well as by the fact that the vomitus assumed the fecal type within a few hours after the advent of the strangulation.

The case is also of interest, in that, notwithstanding the advanced age of the patient, the operation should have caused so little shock and that the subsequent process of repair should have been so satisfactorily carried out.

At the present time, six months after the operation, the condition of the patient is excellent.

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XVII.

UNUSUAL METRORRHAGIA.

By Sidney S. Graber, M.D.

A MORE or less constant or irregular discharge of blood from a uterus is generally regarded as but a local manifestation of some tangible cause, for the most part not difficult of recognition. It may be of an inflammatory nature, either in the endometrium, the uterus itself, the appendages, or other pelvic tissues; or it may be due to some neoplasm either benign or malignant, or to pregnancy, or to some remote constitutional disease. Nearly all cases can be attributed to some one or more of these conditions as causative factors, and relief and cure brought about by suitable medication, by well-defined surgery intelligently applied, or by both. Such cases, however, are of the ordinary type, the pathological conditions being easily recognized, and they respond readily to the usual medical or surgical treatment, which, except where the lesions are grave enough to warrant more radical work, focus into the use of the curette, ergot, and tonics.

For a long time we believed that all cases could be brought within this category; that if one proved in any way intractable it was rather due to faulty *modus operandi*, incorrect diagnosis, or lack of appreciation of the cause as a whole.

We would consider, then, a metrorrhagia unusual when it is of more obscure etiology; when the producing cause cannot well be classed among inflammations, neoplasms (benign or malignant), pregnancy, or constitutional disease; when none of the conditions usually found, up to the present point of investigation, as causes, are evident, and when the lines of treatment generally indorsed and followed prove of little, if any, avail. Such cases, while not rare, are not by any means common. One may see many hundred cases of menorrhagia and metrorrhagia without observing such a one; but

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that they exist for a certainty we may gather from reports of such men as Martin, Olshausen, and others, who have been compelled to resort to operations of a rather radical nature for their relief, not without, of course, first failing in the use of milder means.

These cases, when they present themselves, are exceedingly difficult to manage and to treat with any degree of success, and those seen and recorded have given an amount of trouble entirely disproportionate to what would seem to be the exciting factor, in so far as any disease of the pelvic contents could be elicited; for it is rather by the absence than by the presence of manifest lesions, local or general, that they attract our attention.

It is unquestionably a short road and possibly an easy way to overcome the difficulty by ligating the uterine artery or some of its branches, by removal of the tubes and ovaries, or even by subjecting the patient to a hysterectomy, as has been done; but these are measures which not even those who have performed the operations would advocate as a rule of procedure if gentler means would answer; the safe guide in surgery being that the disease must be, at least, in approximate equation with the extent of the operation. Happily these equations are ever becoming more nicely balanced, and the desire is always to accomplish the most good with the least sacrifice of tissue.

Recently two cases in the out-patient department of this hospital have given me an opportunity of observing the condition in point. Both were married women, aged twenty-four and thirty, respectively.

The cervix, fundus, and appendages were free from disease; no flexions or marked displacement being found. Heart, lungs, and kidneys were normal. There was no history of any tendency to hemophilia. Repeated curettings had failed to give much, if any, relief; and the ordinary vaginal applications and douches also proved futile. In the younger woman, in whom the metrorrhagia was the most severe, the trouble began two years before marriage, though at first it was not profuse enough to cause much alarm. This would exclude one source of irritation. She had never been pregnant, though the pelvic organs were normal in development; she was physically well nourished, but somewhat neurasthenic, doubtless due to frequent and prolonged hemorrhages, which were

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often so severe that quantities of clots would have to be removed; at times it seemed necessary to recommend removal of the appendages, or some operation approaching this.

Searching for some reasonable explanation for such profuse and irregular flow in these cases, it appeared well to direct our attention to the endometrium, with the conclusion based on Napier's theory of menstruation, that the cause might lay in the lack of, or faulty, regeneration of the epithelium of the uterine mucosa, based probably on some defective nerve influence, or on defects in the utricular glands. From this it was thought that some modified form of intra-uterine treatment might be of benefit. This line of treatment was followed by marked success, both patients making a perfect recovery. We could never, ordinarily, advocate or indorse meddling with the interior of the uterus, but rather condemn it as bad practice, either in the use of the sound or the common applicator. However, with a strict adherence to surgical rules and thorough sterilization of all materials and instruments to be brought in contact with the mucous surface of this organ, and a thorough cleansing of the vagina each time it is done, we can at all times feel tolerably safe against infection.

In such severe cases as those here mentioned, the plan adopted was first to fully dilate the cervical canal and to thoroughly curette the entire cavity, following this with a copious intra-uterine saline douche. It is important that a free exit be given for all discharges, and no gauze packing or drainage of any kind should be employed. Then, when, after a variable time, the flow again returns, the douche is to be repeated, but at a temperature of 120° F., given through a small-sized return catheter, a cylindrical (Ferguson) speculum being used, firmly fixed against the cervix, so that the water at its high temperature, and the stronger solutions, will not come in contact with the vaginal wall. In the meantime there has been prepared and held ready for use, in a glass funnel, a small amount of silver-nitrate solution, 60 grains to the ounce, or carbolic acid one in five or ten.

When the salt-water douche is two-thirds finished, the silver solution is allowed to run up to the uterine fundus, and, after a few seconds more or less, washed out with the remainder of the salt-water douche. This treatment applied as often as may seem

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advisable soon gives a more healthful tone to the mucous surface. Internally is given:

Arsenious acid	gr. $\frac{1}{40}$
Strychnia	gr. $\frac{1}{60}$ to $\frac{1}{30}$
Blaud mass	gr. x.
Ergotin	gr. ss. to ij.

With or without cascara at each meal-time.

In conclusion we would emphasize that the cases must be free from deeper disease; the hemorrhages prove stubborn; that everything be made as sterile as possible; that the solutions be kept from the vagina; and that the patient be allowed to keep quiet for some time after treatment.

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XVIII.

CASES OF MULTIPLE EXOSTOSIS.

By Forbes Hawkes, M.D.

Small projections from the surface of one or more bones in children are quite commonly noticed; they usually persist during life and give rise to little or no trouble. A slight deformity may be visible when the projection is directly under the skin, and especially if in the region of one of the smaller joints; when situated along the shaft and under one of the larger muscles they are often overlooked. They are discovered if occasion arises for a careful examination by the physician.

Clinically such projections or exostoses are of comparatively slight importance, for as a rule they give rise to no symptoms, and increase in size only very slowly during the child's growth; after full stature has been attained, their growth ceases; they are not specially liable to undergo malignant degeneration.

Occasionally, however, such exostoses are found to be of rapid growth from the start, and, attaining considerable size in a comparatively short time, become a source of discomfort and danger to the patient in various ways.

When they arise from one of the flat bones or from the end of one of the long bones (a favorite locality), such tumors may soon cause:

(*a*) A considerable degree of deformity. (See Case I.)

(*b*) Serious interference with the action of the muscles attached to the bone in its neighborhood. (See Case I.)

(*c*) Impairment of function in the joint by weakening its ligaments and by an actual distortion of the joint surfaces. (See Case I.).

(*d*) Inflammatory processes in the overlying skin. This is brought about by the pressure and friction of the clothing on the cutaneous surface, its resistance having been already diminished by the pressure of the growing mass below. (See Cases I. and II.)

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Bursæ are also developed over these masses, and these sacs are likewise subject to inflammation.

(*e*) Neuralgic affections of varying degrees of severity, due to the pressure on some of the nerve-fibres. The area of such a neuralgia may be a wide one if the pressure is exerted on a large nerve-bundle before its distribution. (See Case II.)

(*f*) Various thoracic and abdominal pressure symptoms.

(*g*) Cerebral symptoms, due to pressure on the brain of such an exostosis growing from the inner table of the skull.

(*h*) In the female, a possible obstruction of the birth canal. Such exostoses arise from the inner surfaces of the bones of the pelvic girdle or from the lumbo-sacral vertebræ. (See Case II.)

The conditions mentioned above are the main ones which are liable to call for operative interference in cases of exostosis, and it is on account of the presence of several of these indications in the cases here collected that they are recorded in this paper.

Cases I. and II. (own Brother and Sister).

Family History.—No tuberculosis or lues ascertainable. Mother's right forearm was evidently subjected to an intra-uterine amputation. There is no history of exostosis or tumors of any kind in the family. These two children were the second and third born. The first and fourth, aged seventeen and ten, respectively, have been seen by the writer. No exostoses could be found on them. They were perfectly healthy. The first three children born were "cephalic presentations," and forceps were applied. Gestation in all cases was uneventful—no falls, no psychic disturbance. The mother is of rather nervous temperament.

Case I.—E. O'N., aged fourteen; schoolboy. Always perfectly well till the age of seven, when a lump the size of an almond was first noticed by the mother in the region of the right ankle behind. It increased in size gradually and in a backward direction.

Four years later a similar one was noticed at the upper and inner part of the left shoulder-blade. This grew more rapidly, and the skin over it has lately become red and tender.

Other smaller lumps have appeared from time to time on various bones of the body. They have given rise to little or no discomfort.

With the exception of a slight tendency to "catch cold" on exposure, his general health has been good.

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He came for the relief of the pain, discomfort, and disability caused by the lump on his left shoulder-blade.

Examination.—The boy is rather "under size," somewhat anæmic. He presents what is described as a "stocky appearance." His muscles are firm and well developed. The subcutaneous veins of the body are slightly dilated.

Osseous System.—Bones of the Face and Cranium: Normal, except for a nasal septum deflected to the left. *Spinal Column:* Negative. *Clavicles:* Deltoid tubercles are both very large. *Sternum:* Slightly nodular. *Scapulæ:* Arising from the posterior superior angle of the left scapula is a globular tumor about three inches in diameter with a pedicle about three-quarters inch in diameter. Its surface is distinctly nodular. The skin over it is reddened and tender. *Upper Extremity:* Exostoses of varying size are to be felt on the heads of both humeri, on the upper and lower ends of the left radius, and on the lower end of the right radius. The shafts of both ulnas are thickened. There are several small exostoses irregularly distributed on the phalanges of both hands near the epiphyseal lines. *Ribs:* Small exostoses can be felt at the costo-chondral and sterno-chondral edges on both sides, especially on the left side from the sixth to tenth ribs. *Pelvic Bones:* In the left iliac region, just internal to the crest of the ilium and about its middle, is a diffuse hardness. *Lower Extremities:* There are several exostoses of varying size in the upper part of the left femur, in the lower part of both femurs, and in the upper and lower parts of both tibiæ; those in the region of the heads of the tibiæ are larger than the rest. The crests of both tibiæ are markedly "rough"; there is an exostosis arising from the right fibula just above the external malleolus, size about 3 x 3 inches, which has pushed the tendo Achillis backward in its growth, interfering considerably with its action; there is a diffuse thickening of the right tibia in the region of the internal malleolus, which is pushing the foot as a whole outward, causing a weakening apparently of the internal lateral ligament and a resulting beginning "flat-foot"; the tarsal, metatarsal, and phalangeal bones are normal.

The organs of thoracic and abdominal cavity, apparently, are normal. The urine is negative.

Of the various exostoses mentioned above, only those occupying the left scapular and right ankle regions seemed to call for operative

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interference. The mother preferred that the scapular one alone should be attended to.

This was removed under ether anæsthesia, March 17, 1900, through a trap-door incision, so that the stump of the bony pedicle should not be directly under the cutaneous cicatrix. The muscles normally attached to the bone in this region were found to be thinned out and lying over the surface of the tumor. They were retracted to one side and the posterior superior angle of the scapula, which formed the pedicle of the tumor, was removed with it, the bone being sawn across at this point; the parts were brought together by buried catgut sutures. Primary union resulted, and the functions of the left shoulder gradually returned. (This tumor is the one photographed in Plate A.) The boy was placed upon tonics and kept out of doors as much as possible during the remainder of the spring and summer. He improved considerably, his anæmia disappearing entirely.

The condition about the right ankle-joint, however, continued to get progressively worse, and his parents consented to operation.

On February 28, 1901, under gas and ether, an incision was made over the internal malleolus. The fibres of the interior lateral ligament were separated vertically and retracted to both sides. They were seen to be considerably thinned out. A layer of bony tissue about one-half inch thick and corresponding in shape to the cutaneous surface of the internal malleolus was removed. In it was a portion of the epiphyseal cartilage, which was seen to be *non-ossified*, of a yellowish color, and about one-eighth inch thick. The previously separated fibres of the internal lateral ligament were then reunited with chromicized catgut sutures, and the skin closed with silk. The operation restored the internal malleolus to about its proper size.

The corresponding exostosis in the tibia and fibula was then attacked and removed through an incision over the middle portion of the tendo Achillis, the tendon itself being pulled well over to the patient's left side. This exostosis was seen to consist of a shell of bone and cartilage in the lower end of the tibia, filled with creamy cystic contents, which were removed with sponges. It had by pressure apparently caused some absorption of the corresponding part of the fibula. After salt-solution irrigation, this cavity was closed without drainage, and the foot put up in plaster of Paris in an overcorrected position.

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The patient's post-operative behavior was excellent. A few casts were found in the urine the next day only. Both wounds healed *per primam*. Plaster-of-Paris casts were kept on for two months, then "flat-foot" pads were applied for a couple of weeks by Dr. Williams in the dispensary. Later a spring was fitted, and this the boy has worn since then, with absolute comfort and increased security.

A small pedunculated angiomatous tumor just below the point of the right shoulder made its appearance about this time. The handling of this tumor caused its pedicle to become thrombosed and the tumor to fall off. The pathologist reported it as a non-malignant angioma. About ten days later, fifteen to twenty smaller but similar tumors appeared somewhat concentrically and about one-quarter to two inches from the base of the original growth. (See Plate B, photograph.) These were in turn injected with one to five minims of fifty per cent. alcohol, and they shrivelled up, leaving small, scar-like looking areas in the skin. There has been no recurrence since then.

Case II.—S. O'N., aged twelve; schoolgirl. Always perfectly well till the age of nine, when the mother noticed that various lumps were appearing on different bones of the body. These have not caused much discomfort. Of late, however, she has been having considerable pain in the right arm, forearm, and hand of a neuralgic character.

Examination.—The girl is somewhat under size and anæmic, but fairly well developed. The subcutaneous veins of the body are somewhat dilated. *Osseous System:* The bones of the face, cranium, and spinal column, and the clavicles and scapulæ, are normal. *Sternum:* Somewhat nodular. *Ribs:* Several exostoses on the ribs at their chondro-costal junctions. *Upper Extremity:* The heads of both humeri are larger than normal and covered with exostoses of varying size. The right humerus has one larger than the rest, situated along the antero-internal surface about three inches from the head. Pressure of the soft parts against this mass causes the same neuralgic pain of which the patient has of late complained in the arm, forearm, and hand. This exostosis mass is about 1 × $\frac{3}{4}$ inch in size, and projects from the surface of the shaft about $\frac{3}{4}$ inch. The shaft of the right humerus is somewhat bowed. Both radii are bowed somewhat, and there are exostoses on the lower ends of both radii and both ulnæ. The metacarpal bones have several exostoses irreg-

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ularly distributed in the neighborhood of their articular extremities. *Pelvis:* Just above and internal to the antero-superior iliac spine is a bony mass with a broad base about one inch in diameter. *Lower Extremities:* The upper portions and the major part of shaft of both femora are normal. The lower extremities of both bones are thickened and there are several exostoses in the neighborhood of the internal and external tuberosities. Both knees are large and "feel hard." Both tibiæ present exostoses about their heads; the crests of both bones are irregular and the lower ends of both tibiæ and of both fibulæ are irregularly thickened. The right fibula has a distinct mass situated in its shaft just below its middle.

The tarsal, metatarsal, and phalangeal bones are normal. The organs of the thoracic and abdominal cavities are apparently normal. The urine is negative.

The neuralgic pains in the right arm, forearm, and hand seemed so certainly caused by the pressure on the brachial plexus by the growing exostosis in the upper third of the humerus, that the removal of the mass was advised and assented to.

On May 12, 1900, under ether the exostosis was chiselled off. Part of the pectoralis major tendon had to be separated, and a few of the latissimus dorsi fibres divided, in order to get at and properly remove this portion of the bone. The pectoralis major fibres came together again of their own accord. The wound healed *per primam.* By the end of the third day after the operation the neuralgic pain had gotten much less, and at the end of the third week had completely disappeared. There has been no return since, now almost two years.

Examination of the true pelvis made by the combined recto-abdominal method while the patient was under the anæsthetic revealed no exostosis masses in the cavity, an important point in regard to a future pregnancy.

In May, 1901, the exostosis situated in the head of the left tibia began to be troublesome. Its growth had been sufficiently rapid to cause a thinning of and a beginning inflammation in the overlying skin. Its removal was advised on that account. This was done on May 7, 1901, by a trap-door incision. The mass was pedunculated, its size being about 2 × 1¾ × 1½ inches, and was similar in appearance to the one removed from the brother's scapula. The wound healed nicely *per primam* and there has been no further

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growth at this point. This patient also has improved considerably under fresh air and tonics, and at the present writing is apparently in excellent health.

MICROPHOTOGRAPH I.

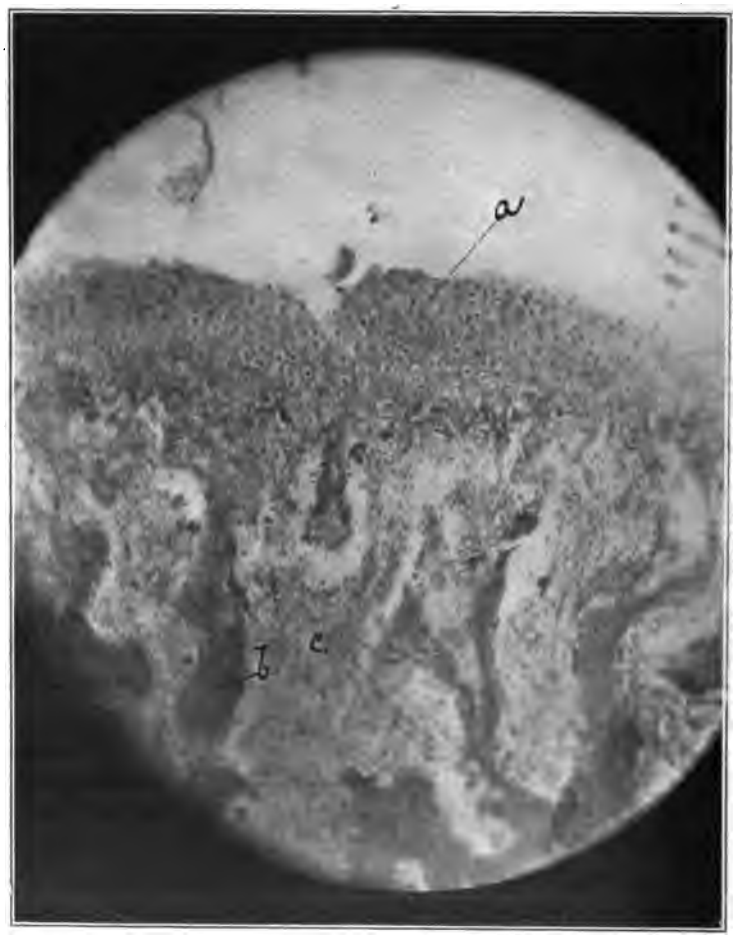

FIG. 1.—Microphotograph of section removed from exostosis of scapula in Case I; *a.*, superficial cartilaginous layer; *b.*, bone tissue; *c.*, fibrous and areolar tissue.

It is of note that in both these cases there was absolutely no recurrence of the masses removed. This is shown both clinically and by the appearance in the radiographs.

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This has an important bearing on the question of the advisability of removing such masses when they are the source of discomfort or pain to the patient.

MICROPHOTOGRAPH II.

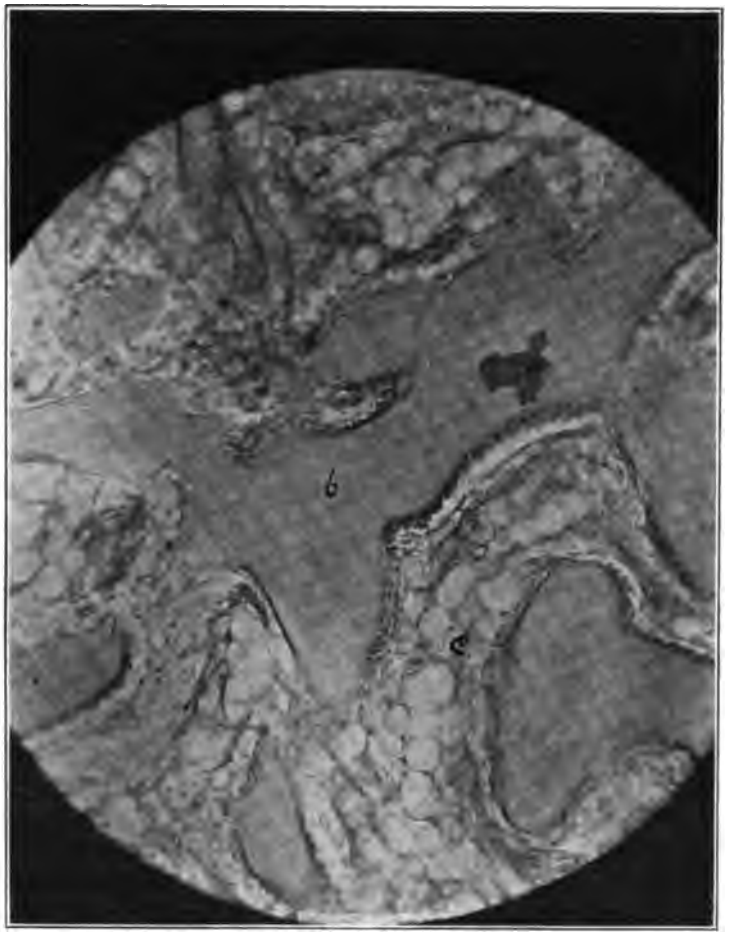

FIG. 2.—Microphotograph of central section removed from exostosis of scapula in Case I ; *b.*, bone tissue ; *c.*, fibrous and areolar tissue.

Macroscopically these exostoses were seen to consist of—

1. Tumors of varying size, situated on the surfaces of the bones and composed of: (*a*) bony tissue merging by a broad base and

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without well-defined line of demarcation into the osseous shaft upon which they were imposed. (*b*) a covering of cartilage of varying thickness, pearly and bluish-white in color, in parts distinctly nodular.

2. More or less globular tumors similar in structure to the above, but united to the shaft by a distinct neck of bony tissue.

3. Tumors situated more centrally in the shaft of the bone and made up principally of friable bony tissue and fat.

4. Tumors similarly situated but with cystic contents (bone cysts).

MICROSCOPICAL REPORT OF THE EXOSTOSES. BY DR. TUTTLE.

Loose spongy bone-tissue. The fibrous tissue throughout is very abundant. The whole is covered by a layer of cartilage. There is nothing suggestive of sarcoma or of rickets.

RADIOGRAPHS.

Radiograph No. 1. *Right humerus* (all except lower end).

Shaft: The upper two-thirds of the bone is markedly enlarged, especially that portion proximal to the deltoid insertion. There is a distinct area of about two inches in length in this region of greater ray penetration (less osseous tissue). A slight depression in the shaft about one and a quarter inches in length can be seen that is made by the removal of the exostosis which pressed on the brachial plexus at this point. (See Case II.) When the arm is placed at right angles to the body the shaft of the humerus is seen to be bent upward (toward the head) through an angle of about fifteen degrees. It would seem as if this bending had occurred mostly in this weakened area proximal to the insertion of the deltoid muscle and through its action. *Head of the bone:* markedly enlarged as a whole. Directly above the epiphyseal line (which is not yet ossified but which shows a plate of denser bony tissue on its upper and lower surfaces) the head of the humerus is apparently made up of very spongy tissue with the exception of a thin layer of bone directly under the articular cartilage. This portion of the humerus is studded with numbers of small exostoses.

Radiograph No. 2.—Radius and ulna, lower two-thirds, and hand of the same extremity as Radiograph No. 1.

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FIG. 3.—Radiograph No. 1.

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FIG. 4.—Radiograph No. 2.

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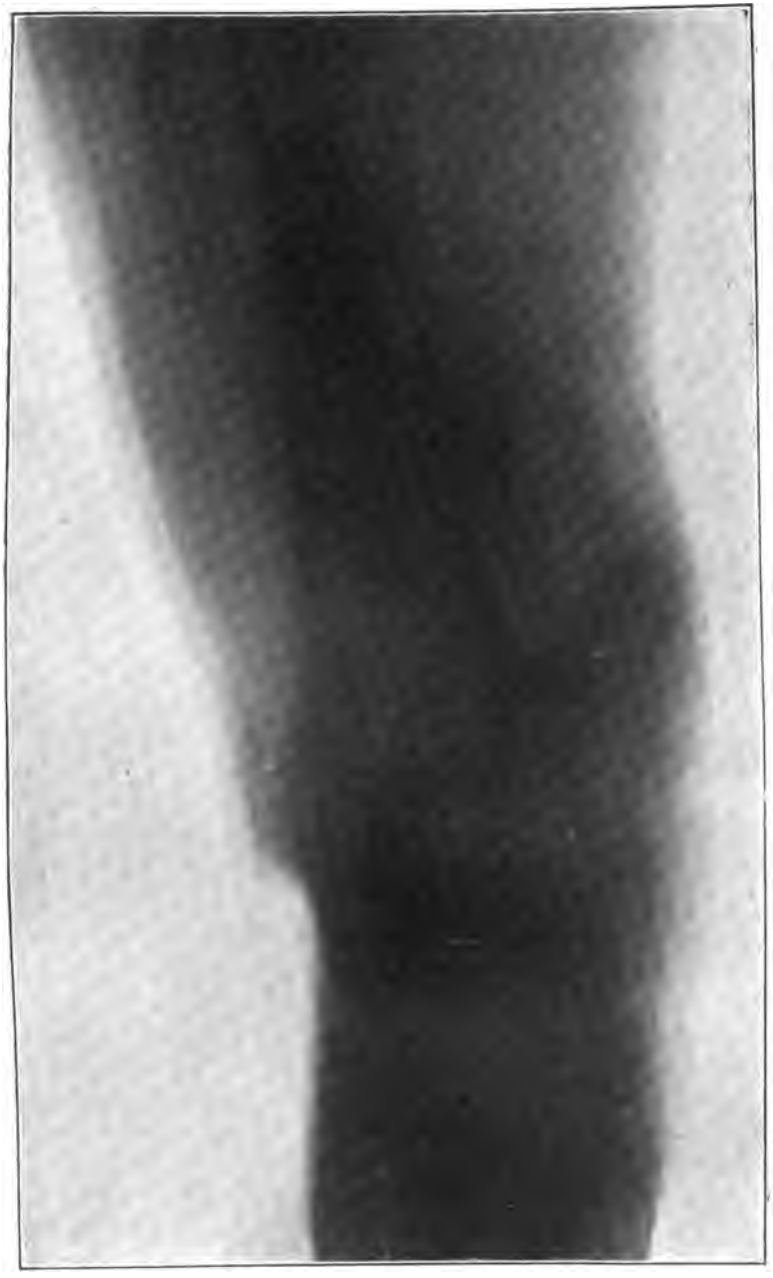

FIG. 5.—Radiograph No. 3.

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FIG. 6.—Radiograph No. 4.

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Radius : The shaft is not specially enlarged, but there is a very distinct bowing of the bone as a whole.

Carpal end : Epiphyseal line seems indistinct and distorted—the styloid process has allowed the rays to penetrate it in a marked manner. An exostosis is seen projecting three-eighths inch from the surface, about one inch from the top of the styloid.

Ulna : Most of its shaft is fairly straight, there is some bowing toward its styloid end. The styloid process is barely visible.

Carpal bones : Indistinct generally. *Metacarpal bones and phalanges :* Shafts and articular extremities seem all to be somewhat thickened. There is no ossification of the epiphyseal lines. Several exostoses can be made out at the ends of the bones in the neighborhood of the epiphyseal lines.

Radiograph No. 3.—Lower two-thirds of shaft of femur, knee-joint, and head of tibia (right side), in Case II.

The shaft of the femur does not seem enlarged about its middle. It is distinctly so, however, in the region of the tuberosities The epiphyseal line is scarcely visible. There are large exostoses occupying the region of the bone just above both tuberosities.

The head of the tibia is enlarged. The epiphyseal line here also is barely visible.

The patella cannot be made out.

Ossification has apparently been premature and excessive about the region of the knee-joint.

Radiograph No. 4.—Right leg, lower one-third, and ankle-joint in Case I.

The shaft and lower end of the fibula is distinctly thickened. About two inches above the ankle-joint there is an area $\frac{3}{4} \times \frac{1}{2}$ inch in the shaft, of almost complete penetration by the rays (bone cyst). Here is also seen an exostosis 3×3 inches, the bony deposit predominating just under the superficial layer of cartilage. The epiphyseal lines are not clear.

It will be seen from the foregoing radiographs that the conditions found in the various bones which are the seat of these exostoses are not the same in each case.

The epiphyseal cartilaginous layer is at times prematurely ossified, at times ossification is delayed or almost absent.

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The conditions seen in the shafts at times resemble those of rickets, at others nothing abnormal can be noted.

The etiology of these growths seems obscure. The condition has been and is still generally believed to be related in some way to that of rickets. Lues has been held responsible in certain cases.

A. Hoffa* speaks of these growths as starting from the fœtal cartilage and subsequently undergoing true ossification (their usual habitat being the cartilaginous ends of the bones). He says that

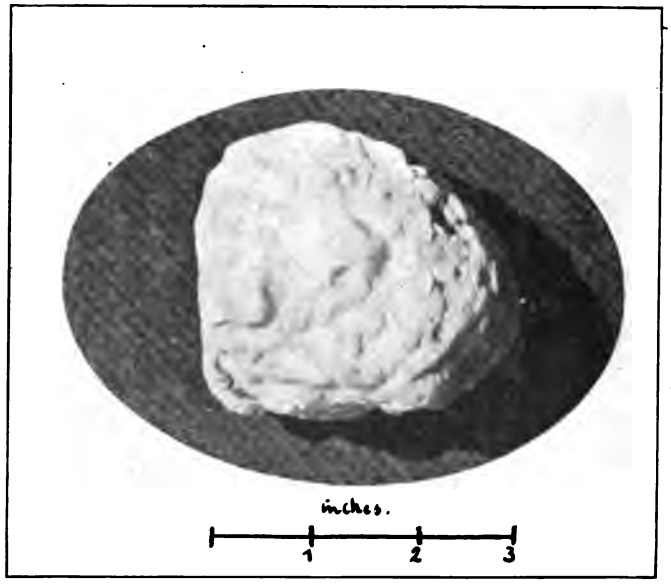

FIG. 7.—Plate A. Exostosis from scapula, Case I.

with few exceptions the epiphyseal line is no longer to be seen. In his cases there had been a previous ossification of the epiphyseal line. The cause of this is to be sought for, according to him, in an early defect of this epiphyseal cartilage; the epiphyseal line disappears as the exostoses grow, and he considers it probable that the material which was to have gone for length formation in the bones, now, owing to changed conditions, goes for breadth formation; that there

* Uber Mult. Kartilag. Exostoses. S. phys. med. Gessellsch. Wurzburg, 1900, pages 15, 16.

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may have been a previous rachitic condition to influence the epiphyseal line, but that for the subsequent growth rachitis is not responsible. He says in these parts we find no evidence of rachitis.

In the cases here recorded there seem to be very distinct evidences of previous rachitis, though of a mild type. The shafts of many of the bones are distinctly thickened, the bones themselves are softer and have bent under the action of the attached muscles and with the weight of the body in a precisely similar way to that observed in rachitic cases. It would seem to us, therefore, that these exostoses have been engrafted on bones previously mildly rachitic.

FIG. 8.—Plate B. Photograph of the angiomatous tumors in Case I.

The question of syphilis has been satisfactorily ruled out in these cases by a careful examination of the parents and from their history.

A blood examination in Case II. after several months of tonic treatment showed an entirely normal condition.

On the other hand it can be said that while in rickets we have early ossification interfered with, here we have to do in places with a premature overgrowth of bone, suggesting the name of ossifying chondromata to these growths.

That the previous condition of rickets has not been a marked one in either case here recorded is shown by the fact that dentition was

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not delayed, that the fontanelles closed about the usual time, that there is no pigeon breast, no enlargement of the cranial bones, no tenderness of the limbs, no fretfulness, no undue sweating, no pendulous abdomen, no enlargement of liver or spleen—the only signs besides those found in the bones being a moderate degree of previous anæmia, a liability to mucous-membrane catarrh, and slight dilatation of the subcutaneous veins.

Many of the exostoses had undoubtedly existed for some time before they were noticed.

The presence in the mother of an intra-uterine amputation has suggested the idea that while in all probability the exostoses in the children are simply concomitant conditions, still they might indicate in some way a blind "inherited" effort on the part of nature at restoration. Researches along these lines in children born of parents subjected in earliest life to mutilating operations would be of interest in this connection.

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XIX.

A CASE OF EPIDEMIC CEREBRO-SPINAL MENINGITIS, WITH AN UNUSUAL SKIN LESION.

By Linsly R. Williams, M.D.

During the extremely hot weather early in July, 1901, the following case of cerebro-spinal meningitis was admitted to the service of Dr. G. A. Tuttle, in the Presbyterian Hospital.

The interesting feature of the case was the character of the skin eruption, the like of which has been rarely observed and generally only in severe epidemics of this disease.

Case.—B. S., aged twenty-six; married; housewife;. born in Russia.

Family History.—Negative.

Personal History.—There is no history of any of the diseases of childhood, and she has always been healthy during adult life.

There is no history of alcoholism or of venereal disease.

Menstruation has always been normal. She has had five normal labors, the last one nine months ago.

She has not menstruated in three months.

Present Illness.—The day before admission she was perfectly well in the morning, and when next seen at noon she was irrational, with high fever and prostration.

On the morning of admission she was wildly delirious and could not be controlled, and some small red spots were seen scattered over the body.

There was no chill, no headache, no backache, no vomiting. Bowels had moved normally.

On admission the patient had a temperature of 102.8° F. by rectum. Pulse was 96, regular and of good force. Respiration regular, 28. She was wildly delirious.

Physical Examination.—The patient was a woman of moderate frame and fairly well nourished.

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The pupils were equal and reacted normally. There was some congestion of the conjunctivæ, and there were several small petechiæ which were apparently subconjunctival.

There was no stiffness of the neck. The tongue was moist and heavily coated with a brownish fur. On the roof of the mouth, on the buccal mucous membrane and on the posterior wall of the pharynx were several petechiæ the size of a pin's head. The heart and lungs were normal. The liver and spleen were not enlarged. The abdomen and extremities were also normal. Scattered over the surface of the body, more numerous over the neck and trunk, were numerous petechial spots. They were so close together that a dozen or more could be covered with a ten-cent piece. They varied in size from that of a pin-head to that of a ten-cent piece, these latter being distinctly hemorrhagic. These spots were not raised; they were of a brownish-purple color, some brighter, almost red. The larger spots were irregular in outline and were situated mainly on the dorsal surface of the hands and feet.

During the first few days the delirium became less marked, and the patient began to complain of frontal and occipital headache. There was some conjunctivitis and photophobia, and a crop of herpes appeared on the upper lip and about the alæ nasi. General hyperæsthesia was also present. On the third day there was some stiffness of the neck, which grew more marked. The fever continued, but not high, and there was a leucocytosis of 25,500. There was little change in the physical examination.

Diagnosis.—With this clinical picture the diagnosis of some form of meningitis seemed probable. The diagnosis was confirmed by examination of the spinal fluid, obtained by lumbar puncture on the sixth day of the disease. About half an ounce of slightly turbid serum was removed, which was examined by Dr. Tuttle, who made the following report:

"Examined microscopically, the fluid was found to contain many leucocytes, in some of which were a number of diplococci which in size, shape, and arrangement in the cell-body strongly suggested the presence of the diplococcus intracellularis meningitidis. None was found in the fluid outside of the cells. Plants made of the fluid upon Löffler blood-serum produced pure cultures of diplococci in all of the tubes. The number of colonies in different tubes varied from two or three minute watery drops to a considerable number

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which soon ran together forming a watery layer of slightly mucilaginous consistence. The growths soon became gray from evaporation or absorption of the fluid. On the third day of growth transplants made upon fresh blood-serum, a larger quantity of the former culture being used, produced only an occasional colony. The microscopical examination of the cultures showed diplococci and occasionally short chains of four to six corresponding in every particular with descriptions of the diplococcus intracellularis meningitidis."

Clinical Symptoms.—A number of herpetic vesicles appeared on the third day on the upper lip and on the nostrils. These soon crusted over and gradually dried up in ten days' time.

Mental Symptoms.—Delirium. During the first two days this was of a noisy maniacal type. Subsequently the patient was in an apathetic condition for three weeks, muttering irrationally by day and noisy at night. She could be roused sufficiently to answer questions and she made known her wants, usually in a whining, disagreeable way. Her mental equilibrium was not regained until after the fourth week. She was never comatose.

Sensory Symptoms.—There was hyperæsthesia during the first week about evenly distributed over the surface of the body, sometimes marked over the joints.

Headache was quite marked, beginning in the middle of the first week and lasting ten days. It was frontal and also occipital.

There was also pain in the back of the neck with tenderness on motion of the head. There was no tenderness along the spine.

Motor Symptoms.—During the first week grimaces were present. There was marked rigidity of the neck, noted first on the third day and lasting full three weeks and then gradually subsiding. There was no other rigidity. There were no convulsions. Kernig's sign was never present, nor Babinski's. Reflexes remained normal throughout the disease.

Gastro-Intestinal Tract.—The tongue became slightly swollen, causing some thickness in speech, otherwise the tongue remained in fair condition. Vomiting was never present. There was a tendency to constipation and the bowels were moved by catharsis or enemata. Fæces were involuntary only during the first two days of active delirium.

Special Senses.—There was slight conjunctivitis during the first week. The petechiæ were all absorbed. Photophobia was present

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also during the latter part of the first week. Pupils remained normal throughout the disease. Ophthalmoscopic examination showed a normal fundus. Ears were normal. There was no coryza.

Fever.—This was decidedly irregular; the highest, 103.5° F., on the fifth day, usually between 99° and 101° F. After the sloughing in the skin commenced the temperature was of a low, hectic type, 98° in the morning and 100° in the evening. The temperature remained normal after the thirty-third day.

Urine.—Voluntary, except during the first two days. Repeated examinations showed a specific gravity from 1014 to 1022. Acid, containing a trace of albumin, a few leucocytes, and on one occasion many hyalin and a few granular casts. The amount varied between thirty and fifty ounces in each twenty-four hours.

Blood.—

3d day	Leucocytes	25,500
6th "	"	21,800
9th "	"	22,700
13th "	"	20,400
22d "	"	7,600
41st "	"	7,000
41st "	Red Cells	3,300,000
41st "	Hæmoglobin	65 per cent.

A blood culture, taken on the sixth day, showed some diplococci resembling the intracellularis, but they were thought to be the result of contamination, as the growths were not typical.

Eruption.—The character of this petechial and purpuric eruption, as it appeared on the second day of the disease, has already been described.

It was a profuse petechial eruption over the entire body, with larger purpuric areas mainly over the hands and feet.

During the second forty-eight hours some of the smaller spots faded, and there was a gradual appearance of fresh petechiæ.

The large, irregular purpuric areas became distinctly raised at their edges, but not in the centre.

On the sixth day there were still some petechiæ appearing, but fewer in number, and most of the smaller petechial spots had faded.

The purpuric areas gradually lost their bright color and became brownish-purple and then black. The edges became more raised, and there was some serum beneath the epidermis. The color grad-

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ually changed from black to a mottled gray and black, and then to a dull leaden grayish hue. (See Plates I. and II.)

By the ninth day the epidermis around the edges broke, and then began a sero-purulent discharge, followed by sloughing at the margins of all these large hemorrhagic areas.

In a few days more the sloughs began to separate, and the sloughing continued through both layers of fascia, leaving deep, round, punched-out areas, most numerous on the hands and feet, and the largest ones being on the left upper arm and left buttock, where they were a full inch in diameter and nearly an inch deep, the muscle planes being visible. (See Plate III.)

After discharging some thin pus for another week, the ulcerating areas began to fill in with granulations, and on the twenty-eighth day all had completely granulated over and cicatrization commenced.

There was considerable pain and discomfort connected with the process of ulceration, which disappeared as healing set in.

Urticaria.—In the early part of the fifth week there were aching pains in the arms and legs, with itching and burning of the skin, lasting twenty-four hours.

At the end of this time an erythematous eruption appeared over the legs and arms, urticarial in character. There were no wheals, but a number of small nodules the size of a pea were felt just beneath the skin. The erythema lasted two days, the nodules a day or two longer, gradually disappearing.

A petechial eruption in this form of meningitis is not uncommon.

Subcutaneous hemorrhages are rarer, but they are described by most authors. A profuse hemorrhagic eruption so intense as to produce sloughing is little mentioned. Osler says that in rare instances, gangrene of the skin has been noted.

Councilman, in the report of the Massachusetts epidemic, describes a case with a hemorrhagic eruption, where some of the purpuric spots became purulent in the centre.

Gordon, in the *Dublin Quarterly Journal of Medical Sciences* for 1867 describes eruptions seen in the Dublin epidemic during that year.

He is quoted in Allbutt's "System of Medicine" as saying "that there may be hemorrhagic eruption coming out all over the

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FIG. 1.

FIG. 2.

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FIG. 3.

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body, but chiefly in the lower limbs, dark in color, being brown, purple or black as ink; some spots small and round, others larger and more irregular in color and shape, others raised above the level of the skin. These may be gradually absorbed or may in some cases become gangrenous."

Almost all of the hemorrhagic cases have been of a malignant type with usually a fatal termination.

Course of the Disease.—The symptoms continued for four weeks, but the improvement commenced at the end of the third week. The symptoms were never very severe, but the malignant character of the eruption caused some anxiety. There was a moderate amount of emaciation and a moderate anæmia.

The fever continued longer than most of the symptoms, due probably to the suppuration in the skin.

The pulse was always regular and of fair quality, varying with the temperature, the rate being 100 to 120 per minute.

The respirations were normal and examination of the lungs never revealed any signs of congestion or consolidation.

There was never any abdominal distention. The patient was allowed to sit up in bed at the end of the fourth week, and on the fortieth day she was was walking about. She was discharged cured on the forty-seventh day. Physical examination then showing only the fresh cicatrices scattered over the body, and a soft hæmic murmur at the heart's apex.

Treatment.—Salicylate of soda was administered in moderate doses. Small doses of sodium bromide were given to control the delirium. A good amount of fluid food was given and the bowels were kept open. The usual care was given to the mouth and skin. The lesions of the skin were treated on ordinary surgical principles. Tonics were given during convalescence.

Subsequent History.—The patient was seen three months after her discharge from the hospital and she stated that since then she had been in good health, and that her mental condition was the same as before her illness. She had had a few headaches and was a little weak at times. There had been some pains in the scars. She had had no aural or visual disturbances.

She thought she was about seven months pregnant. Physical examination was normal, except for an abdomen which evidently contained a normal pregnant uterus at the seventh month. There

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were a number of cicatrices scattered over the body, some a full inch in diameter. These scars were very noticeable over the hands and feet.

I wish to express my thanks to Dr. Tuttle for his many kind suggestions and for his report on the spinal fluid. I also wish to thank Miss Granat for the photographs of the skin lesions.

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XX

CALCULUS OF THE RIGHT URETER. LOSS OF FUNCTION IN THE RIGHT KIDNEY, WITH COMPENSATING HYPERSECRETION OF THE LEFT. REMOVAL OF CALCULUS BY THE TRANSPERITONEAL ROUTE. RECOVERY.

By Forbes Hawkes, M.D.

On August 13, 1900, S. H., aged twenty-three, married, housewife, presented herself at the Presbyterian Hospital with the following history:

Family History.—Several members have died of consumption; father died of vesical calculus.

Menstrual Life.—Normal, except that there has been no menstruation since the birth of her first and only child, seventeen months ago. No miscarriages.

Previous History.—The ordinary diseases of childhood; erysipelas at the age of eight. Diphtheria at eighteen; no sequelæ.

Present Trouble.—For several years she has been subject to attacks of nausea and vomiting, associated with frontal headache and pain in both eyes. The attacks have lasted from two to three days, and during them she has seen black specks before her eyes.

Two years ago she began to be troubled with frequent and painful micturition; she had pain in both hips running into the groins. Shortly after labor she passed a calculus from the bladder of about the size of a bean. See Fig. 1. This was followed by the entire cessation of the pain and of the previous symptoms, with the exception of the frequency of micturition, which persisted. There was occasionally some blood in the urine.

About one year ago she began to have fleeting pains in all the limbs, associated with dyspnœa, slight palpitation of the heart and marked prostration. The legs and feet would occasionally swell and there would be small painful pinkish spots appearing upon

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the limbs and trunk. She has never been able to recover her strength.

Two weeks ago she felt sick and weak enough to go to bed and stay there with anorexia, headache, "spots before her eyes," swelling of the legs and feet and a severe dull ache in the lumbar region. The urine, previously scanty, has of late been gradually increasing in amount. She is habitually constipated.

On admission to the medical division of the hospital her condition

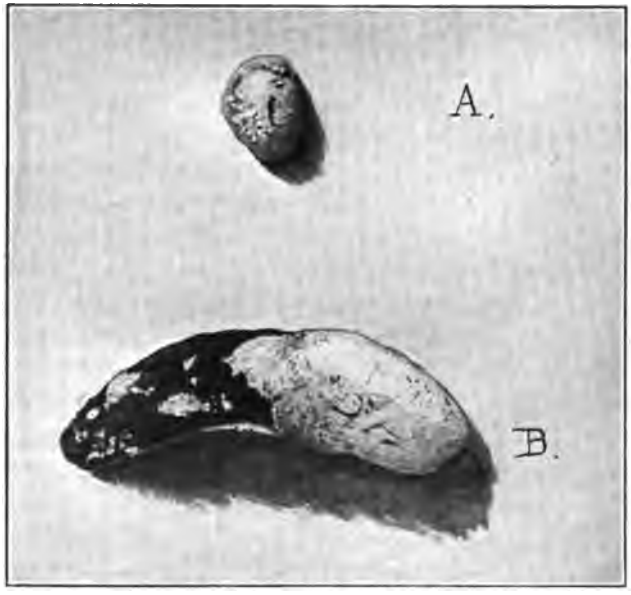

FIG. 1.—*A*. 1st Calculus passed in 1899 (exact size); *B*. Calculus of the right ureter removed December, 3, 1901 (exact size).

was as follows: Poorly nourished, emaciated, and anæmic; the cervical supra-clavicular and axillary glands are enlarged. The tongue is slightly coated. There is some tension to the pulse, the vessel wall is somewhat sclerotic. *Heart:* apex impulse is in fifth space, 3½ inches to the left of the midsternal line; the left limit of cardiac dulness corresponds; action is regular and of good force. The second sound is accentuated at the base, especially over the aortic area. *Lungs:* slight dulness at the right apex anteriorly and posteriorly; behind some subcrepitant râles on coughing. *Liver:*

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percusses from the sixth rib to the costal border. Palpation is, however, distinctly unsatisfactory on account of the rigidity of the abdomen. The *spleen* is not made out. The *abdomen* is held rigid: there is soreness over and above the pubes. There is no tenderness in the upper abdomen; no masses can be felt. There is considerable œdema of the legs and feet.

Urine.—The patient remained in the hospital for about two weeks; during this time the urinary examinations were as follows:

Specific gravity, 1009–1016.

Alkaline, persistently.

Turbid.

Albumin; trace to fifteen per cent.

No sugar.

Triple and amorphous phosphates usually.

Pus in varying amounts (usually considerable).

Mucus, constant.

Red blood-cells occasionally.

Indican reaction present once.

No casts were found.

The daily amounts of urine varied from 38 to 67 ounces, the average being about 50 ounces.

Leucocyte count, 9,800 per cubic mm.

Hæmoglobin, sixty-five per cent.

Her temperature was usually in the neighborhood of 100° F. by mouth; the pulse rate, 70 to 80.

The constant rigidity of the abdomen prevented a satisfactory palpation.

She left the hospital somewhat improved as to her general condition.

During the next fourteen months she twice re-entered the hospital, each time for a few days. A few casts were found several times in the urine; otherwise the urinary examinations were about the same. The ophthalmoscope revealed an albuminuric retinitis. A noticeable feature in her case was that while her general symptoms gradually improved the pain in the lower abdomen on the right side persisted and increased in severity; the right rectus muscle was always held rigid, preventing the satisfactory recognition of the underlying conditions. The urine was being passed in larger quantities.

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On December 3, 1901, the patient was seen in consultation with Dr. Laffin of this city, under whose care she had come, and who had found on vaginal examination an elongated mass, apparently of inflammatory origin, but of stony hardness, situated low down in the pelvis on the right side. Its density suggested a calculus. An exploratory operation seemed indicated.

Operation (Ether).—Trendelenburg's position. Vertical median incision through the right rectus muscle. No free fluid in the peritoneal cavity. Uterus, ovaries, and tubes normal. On the right side, at the deepest part of the pelvic fossa and extending from the neck of the uterus almost to the right sacro-iliac joint, a hard mass could be made out, about three inches long by one and one-half inches wide, situated under the peritoneum. The cellular tissue, for perhaps half an inch in all directions, was somewhat indurated. A diagnosis of ureter calculus was confirmed.

An attempt to push the calculus downward toward the bladder was without avail. Its size was evidently out of all proportion to that of the lumen of the ureter below. Lying as it did just below the brim of the pelvis it could not safely be reached retroperitoneally from the loin without a very large incision, and the patient was in no condition to stand such a procedure. It was thought best, therefore, to remove it as follows (Fig. 2):

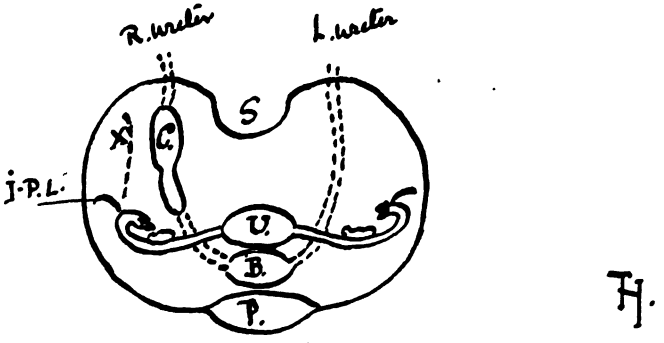

FIG. 2.—Diagram of the location of the ureter calculus and of the peritoneal incision used in its removal. *P*, pubic bone; *B*, bladder; *U*, uterus; *X*, line of incision of peritoneum for removal of calculus; *C*, calculus lying in ureter. *I.P.L.*, infundibulo-pelvic ligament; *S*, promontory of sacrum.

After cutting the right rectus abdominis muscle transversely, about two inches below the level of the umbilicus, to afford greater

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room, and protecting the general peritoneal cavity thoroughly with hot sterile pads, an incision was made in the pelvic peritoneum about two and one-half inches in length, well to the outer side of the mass and just to the inner side and back of the right infundibulo-pelvic ligament. This opening was deepened in the underlying cellular tissue with the fingers until a funnel-shaped cavity was formed, at the bottom of which lay the ureter with its imprisoned calculus. Freeing the ureter from its neighboring structures in a similar way, the operator's left index finger was hooked under it and kept there until all the work on the ureter was completed. The mass being brought well up into the wound, a longitudinal incision about three-quarters of an inch long was made, opening into the lumen of the ureter and on to the calculus at its lowest point. Through this opening the stone was drawn downward and delivered. There was no escape of pus, urine, or other fluid from the ureter opening. The calculus itself was seen to be comparatively dry. Passing the right index finger into this cavity in the ureter no débris or other calculi could be felt. The ureter walls here felt exceedingly firm, almost cartilaginous. A long silver probe passed downward into the bladder easily; upward it seemed to catch at the pelvic brim, but nothing abnormal about the ureter could be felt through the peritoneum at this point. The incision in the ureter was now closed with interrupted fine black-silk sutures which did not penetrate the lumen of the tube, about five of them being inserted.

This procedure was much facilitated by the presence of the left index finger under the ureter at this point, for by it the tube was kept in an accessible position, the sutures being tied by the assistant. The sutured ureter was now dropped into its proper place. Retroperitoneal drainage was then effected in the following way: The operator's left index finger was made to push its way under the peritoneum, starting posteriorly from the incision back of the infundibulo-pelvic ligament in a direction upward, backward, and outward, and was cut down upon from the skin surface through the lateral abdominal muscles in the right lumbar region about an inch above the crest of the ilium. A narrow strip of sterile gauze was passed down as a drain through this channel to the sutured ureter.

The edges of the peritoneal incision back of the infundibulo-pelvic ligament were now brought into very close approximation by

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a continuous catgut suture, shutting off the wound of the ureter entirely in this way from the general peritoneal cavity.

The protecting pads were removed from the peritoneum and the abdominal wall closed layer by layer, the peritoneum with plain catgut, the muscle and fascia with interrupted sutures of heavy chromicized catgut.

As excessive care had been used not to soil the peritoneum during the work on the ureter, and as no urine whatever was seen to issue during this time from the incision in the ureter, it was thought best not to drain the peritoneal cavity.

Time of Operation.—Anæsthesia, about one hour; operative procedures about fifty minutes.

[A hasty examination made toward the end of the operation before closing the general peritoneal cavity revealed nothing abnormal with the rest of the right ureter or kidney.]

The patient made an excellent post-operative recovery, her highest temperature and pulse-rate being 102.6° F. and 120 the next day —both gradually subsiding to normal on the fourth day. The successive daily amounts of urine voided were :

First day, 885 c.ctm.

Second day, 925 c. ctm.

Third day, 975 c. ctm.

Fourth day, about 1,100 c. ctm.

Fifth day, 1,272 c. ctm. Later on the amount varied from 1,200 c. ctm. to 2,000 c. ctm.

The urine contained gradually diminishing quantities of albumin, pus, and blood-cells. Thin elongated clots of blood were passed on the first and second day, none afterward. Mucous shreds came away in the urine at intervals for several days. No renal casts were found at any time in any of the specimens.

There was very slight nausea after the operation. Water was therefore freely given by mouth. The bowels moved by enemata on the third day, and after that regularly.

The gauze drain in the lumbar region leading down to the sutured ureter showed no evidences of urinary leakage at any time. There was simply the usual post-operative blood-staining. It was removed on the fifth day and a smaller one substituted. Three days later it

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was entirely withdrawn, a small skin drain being left in for a few days. No sinus formed. The median abdominal wound healed nicely.

The patient was out of bed the third week, entirely relieved from the old pain.

On cystoscopic examination, January 11, 1902, there was seen—

(*a*) A right ureter opening, seemingly contracted and "puckered in" in which a small plug of mucus could be detected. No urine was seen to escape from the opening during the examination.

(*b*) A left ureter opening, around which there were several small reddish nodules bathed by the stream of urine which seemed to come not only in spurts but more or less continuously.

(*c*) The rest of the vesical mucous membrane seemed only slightly congested.

An examination of the abdominal wound showed that the right rectus muscle at its transverse division had healed firmly, the muscle contracting well as a whole; there was no suggestion of a subsequent hernial weakening here.

Calculus.—The calculus removed weighs 158 grains, it is "curved" (see Plate 2, Fig. B.) the curve being about that which the ureter has normally in that portion of the pelvis from which the stone was removed. It is 2½ inches long on its convex surface. It is apparently made up of two distinct portions or approximate halves; where these are joined together there is a spiral groove; the upper (the larger) portion is smooth, rounded, and glistening, and consists apparently of phosphatic deposits; the lower is more rough and elongated and is covered by a thin incrustation of blood-stained calcareous material.

The patient's history, considered in conjunction with the size and shape of the calculus, has suggested the following to the writer:

The first calculus was the cause, either by its passage or by its temporary lodgement in the right ureter, of a spiral stricture of that canal in its pelvic portion. Around this stricture the urinary salts were deposited, blocking up the ureter little by little at this point and causing a gradual atrophy of the right kidney from the back-pressure of the urine, until finally the functions of that kidney ceased. The left kidney, at first unable to carry on the suspended functions of the right (as seen by the œdema of the feet and legs, increased arterial tension, shortness of breath, palpitation of the

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heart, toxic eruption on the body, headache, specks before the eyes, general debility, etc.), gradually met the demand upon it, as shown by the subsidence of all the previous symptoms with the steady increase in the quantity of urine secreted, and the ureter calculus became simply a source of pain and discomfort to the patient from its situation and from the suppurative ureteritis which it caused.

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XXI.

A CASE OF SUBCUTANEOUS RUPTURE OF THE TRACHEA, WITH REMARKS ON FORTY-THREE SIMILAR INJURIES.

By Alfred T. Osgood, M.D.

J. Z., aged forty-two; single; German; truck-driver; was admitted January 26, 1901, at 1 P.M., into the service of Dr. McCosh.

History.—While currying a horse this morning he was kicked upon the chin, inflicting a wound over the right side of the jaw. He is certain that the horse's hoof did not strike his neck. There was no loss of consciousness. There has been marked pain in the mouth on attempting to open and close the jaws in speaking, etc., and soon after the injury he began to have difficulty in breathing, especially on inspiration, with frequent coughing and expectoration of bloody mucus. He has also noticed swelling of his neck and face, and has been unable to lie down because of increased dyspnœa in this position.

Physical Examination.—Man is of medium frame; muscular; evidently in pain; is compelled to sit upright because of marked dyspnœa in recumbent position. Examination of the heart, lungs, and abdomen shows nothing abnormal. Pulse 80, of good quality. Face and neck are swollen to a considerable extent.

There is a lacerated wound extending down to the periosteum of the inferior maxilla, 1¼ inches long, situated just to the right of the median line, overlying the lower border of the inferior maxilla, which has been cleaned, sutured with silk, and dressed in the Emergency Ward. There is a fracture extending vertically between the median lower incisor teeth completely through the body of the inferior maxilla, which is compound by laceration of overlying mucous membrane. A firm four-tailed bandage is applied. There is subcutaneous emphysema extending from the temporal regions on both sides of the head, downward over the face and neck to the level of the clavicles,

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and posteriorly to the anterior borders of the trapezius muscles. No bleeding from the ears or nose, but patient coughs frequently and expectorates bloody mucus. There is no redness or ecchymosis in the skin of the neck; no evidence of contusion of the chest; no pain in the neck; no marked point of tenderness in the neck over the larynx or trachea; no fracture of the hyoid bone, of the cartilages of the larynx or of the trachea can be made out, but examination is unsatisfactory because of swelling (emphysema) of the neck; no difficulty in swallowing. Temperature, 100° F.; pulse, 84; respiration, 26.

Laryngoscopic examination immediately after his admission revealed nothing abnormal in the larynx except some bloody mucus.

A diagnosis of rupture of part of the respiratory tract below the glottis was made. Cold, wet compresses, with a firm bandage, were applied to the neck, and he was propped up in the position found most comfortable. His only complaint at this time was of slight dyspnœa and consequent inability to sleep. During the evening a moderate dose of morphine (U. S. Solution 3 ij.) was given him, and he was constantly watched to guard against marked increase in dyspnœa or œdema of the glottis.

By the next morning (January 27) subcutaneous emphysema had gradually increased so that it involved both arms and the entire chest anteriorly and posteriorly; dyspnœa was more marked; inspiration prolonged, labored, and slightly stridulous; cyanosis of lips and face was slight. He became markedly cyanotic and respiration was almost impossible on assuming recumbent position for a moment. His pulse remained good, 86 per minute. During the day no improvement was noted. The emphysema gradually increased until it extended to the thighs, and swelling of the neck was more marked. The expectoration of bloody mucus in considerable amount continued. Dyspnœa increased during the afternoon.

Tracheotomy was deemed advisable, and this was done at 6 P.M. by Dr. Forbes Hawkes.

Operation January 27, 1901.—With the patient sitting up, a four per cent. solution of cocaine was injected subcutaneously, and an incision two inches long was made in the skin in the median line of the neck below the level of the cricoid cartilage and deepened by blunt dissection till the trachea was exposed, when air could be heard passing in and out with respiration through a lacerated, irregular-

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shaped wound which was found in the fibrous membrane between the 2d and 3d rings of the trachea, extending one-quarter of an inch to the left from the median line. Tracheal rings were intact. The 3d, 2d, and 1st cartilaginous rings were incised in the median line, and a large tracheotomy tube was inserted. This was followed immediately by great relief to the patient, and he expelled through the tube some clotted blood and mucus. For twenty-four hours he continued to cough up through the tracheotomy tube blood-stained mucus. During the night following operation he slept fairly well.

The inner tube of the double tracheotomy tube was removed and cleaned of inspissated mucus several times each day. The emphysema slowly decreased after the third day. His temperature ran an irregular course till February 7 (the thirteenth day), after which it was normal. His pulse was at no time rapid, varying between 78 and 104 per minute, and always of good quality. Respiration was labored before operation, but the rate was only slightly above normal. After operation respirations varied between 22 and 28 per minute.

Examination of the chest was very unsatisfactory for twelve days because of subcutaneous emphysema, but no evidence of pulmonary consolidation was found. Breath sounds were harsh, expiration prolonged, and numerous coarse and fine râles, difficult to distinguish from subcutaneus crepitation, were to be heard over the entire chest.

The wound on the chin healed by primary union. On February 5 (eleventh day), the tracheotomy tube was removed and the edges of this wound were drawn together by a strap of adhesive plaster, and the wound rapidly closed, so that on February 16 (twenty-second day), when the patient left the ward, a small superficial granulating area remained. The fracture of jaw had only partially united at the time of his discharge from the hospital, but the position of fragments was good and he was still wearing a four-tailed bandage.

When last seen, October 28, the skin of the neck beneath the tracheotomy-scar was freely movable, not adherent to underlying tissues. No irregularity in conformation of trachea could be felt, except slight induration in the line of the scar. He has had a cough with mucus expectoration, and his voice has been thick and harsh for six or eight months. The cough has a brassy quality. He

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suffers from dyspnœa on severe exertion, as in carrying heavy weights. Probably there exists a constriction of the lumen of the trachea at the site of the rupture and tracheal incision, but this has not been definitely made out as yet.

This case presents points of interest in that the injury is not a common one and that the traumatism was not exerted directly upon the trachea, but upon the chin, producing rupture of the trachea by forcible sudden extension and elevation of the head.

Records of open wounds of the trachea as from cut-throat, stab and sword wounds or even by gunshot wounds are not frequent. Subcutaneous wounds of this organ have been less frequent.

I have found reports of 43 cases of subcutaneous rupture and fracture of the trachea, 33 of which were tabulated by Brigel,* and comprised nearly all the records in medical literature of similar injuries that had appeared previous to his own case.

Reports of ten additional cases have been found.

Cause.—Direct traumatism over the trachea has been the chief cause of this injury by compression of the neck and chest (9 cases), as in run-over accidents, by blows received upon the neck (13 cases), by striking the neck against solid objects in falling (6 cases), by hanging, throttling, etc. (5 cases).

Two cases,† in addition to two cited by Brigel, of rupture of the trachea due to violent expulsive cough have been found. One case‡ was due to the explosion of gunpowder in the mouth with suicidal intent.

One case of intussusception of the trachea, caused by forcible flexion of the head upon the chest was reported by Lang.§

In two cases the cause was not given.

Two cases have been found in which the traumatism was not directly exerted upon the neck over the trachea but where rupture of the trachea was produced by sudden forcible extension of the head as in the case above described.

* Beiträge für Klinische Chirurgie, 1895, vol. xiv., pp. 517-538.

† Latour (1808) and Gescheidt (1855). See Voss, New York Journal of Medicine, 1860, p. 37. Bredschneider, Wochenschrift fur die ges. Heilk, Berlin, 1842, p. 461. Lefferts, New York Medical Record, 1882, vol. xxii., p. 599.

‡ Scharf Blasius Klinisch. Zeitshrift für Chirurg. und Augenheilk. Bd. I, 1836, p. 255. See Brigel, op. cit.

§ Memorabilien, xxi., 1876. See also Brigel, op. cit.

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(I.) Sonderland * in 1826 reported the case of a boy who in fright suddenly threw his head back as far as possible. This was followed by emphysema of the head, chest, abdomen, and limbs. When his head was bent forward there was no increase in emphysema and with the head fixed in this position by bandages for ten days, he recovered. This was probably an instance of rupture of the trachea.

(II.) In the case reported by Berger † the cause was similar to that in our case. A soldier was kicked by a horse, the hoof striking beneath the jaw inflicted an unimportant wound in the skin. His neck became markedly swollen and breathing was difficult. He complained of a sense of pressure in the epigastrium and of the feeling that blood was flowing into his windpipe. There was no evidence of fracture of the larynx.

In a few moments the emphysema spread over the neck and chest. He was bled from the arm and leeches were applied to the neck. He survived one hour and a half. Autopsy revealed the trachea torn from the larynx for two-thirds of its circumference. The trachea was filled with blood-clots.

Lesion.—The lesion has in the majority of cases been situated above the sternum. In severe crushing accidents only has the intra-thoracic portion been involved; in two of these at the bifurcation; in one case the trachea was torn from the left bronchus.

The laceration of the trachea has been accompanied with fracture of the sternum or ribs in six cases, with fractures of the cartilages of the larynx in thirteen cases. In four cases the trachea was torn from the larynx.

Suppuration has developed about the site of the tracheal wound in at least four cases, three of which are to be found in the list below.

After transverse division of the trachea, during inspiration, the lower portion is drawn down while the larynx and upper portion of the trachea remain almost stationary; in this way the rent is opened to a greater or less degree depending upon its extent and upon its direction; if the laceration be directly transverse the separation of

* Neue Jarhbücher der deutsch. Med. und Chirurg., 1826, Bd. 12. Also Brigel, op. cit.

† Med. Zeitung des Vereins f. Heilk. in Preussen, 1856, s. 160. Also Brigel, op. cit., and Lancet, 1856, ii. p. 277.

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its edges is greater than is the case in oblique or longitudinal lacerations.

Symptoms.—Pain referred to the site of injury was present only in the more severe lacerations after the pain due to the contusion of the overlying tissue had disappeared, *i.e.*, the wound of the trachea itself gave little pain except in marked lacerations.

Dyspnœa was a marked symptom in every case.

Emphysema usually developed rapidly, in some cases within a few hours involving the entire body to the fingers and toes. Emphysema of the neck increases the dyspnœa.

Cough and bloody expectoration giving evidence of a laceration of the tracheal mucous membrane were present in the majority of cases and are dangerous symptoms ; for in several cases, the coagulated blood in the trachea has accumulated in such an amount as to prevent respiration. In one remarkable case reported by Long * the wound was transverse between rings with a separation of one inch between the edges of the wound. Tracheotomy was performed, a tracheal cannula introduced, the blood and mucus clogging the trachea were sucked out and the lungs inflated by blowing into the cannula. This patient recovered.

Deglutition was difficult in some cases.

Symptoms of hemorrhage and shock were present in the severe injuries.

In some cases the rent in the trachea has been demonstrated by palpation.

Treatment—Palliative treatment has been efficient and successful in nine cases, as Brigel reported. This has consisted in cold applications, compression of the neck by a firm bandage and fixation of the head in the position of marked flexion.

Operative treatment by tracheotomy and the insertion of a cannula or tracheotomy tube, has been employed in 12 cases, 7 of which have recovered. The case (in table below) by Park was treated by incision into the suppurating tissue of the neck with drainage and was followed by recovery.

Ghedini's case is unique and interesting in respect to treatment. He exposed the trachea, discovered the wound, 2 ctm. long, extending almost longitudinally with a slight obliquity from behind forward on the left side of the trachea. Iodoform gauze was packed

* Medical Times and Gazette, 1859, vol. ii., pp. 383 and 457.

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over the tracheal wound. His case recovered completely, and he argues against tracheotomy in similar conditions; but it is important that in his description of the symptoms there is no mention of expectoration of blood, which would indicate that the laceration of the mucous membrane was slight, with little or no hemorrhage into the trachea, and therefore one of the chief indications for tracheotomy was not present, viz.: to secure the patency of the lumen of the trachea and clear it of blood.

In but one of these cases has suture of the tracheal wound been attempted (Gelpke, table). Other methods of treatment were as follows: Bleeding and leeching, 1; stimulation and palliative, 2; scarification for emphysema, 1; in each instance the patient died. No record of treatment was given or none was attempted in seventeen cases. Many of these patients died before surgical aid could be obtained.

Results.—Of the total of 44 cases of which records have been found, with the case described in this paper, 27 have died, giving a total mortality of sixty-one per cent.; 17 died within forty-eight hours. In 18 of these cases the tracheal lesion has been complicated by fractures of the cartilages of the larynx, of the sternum, or of ribs. In 26 the trachea alone has been injured. Of these isolated tracheal injuries (rupture and fracture), 12 have died, and 14 have recovered, that is a mortality of forty-six per cent.

This is therefore a serious injury threatening the life of the subject, unless promptly treated by proper means. The conditions of danger are interference with respiration and with the heart's action and the results of infection in and about the wound of the trachea. Respiration is interfered with by solution of continuity of the air-tube, by hemorrhage into the trachea which may occlude it, by the pressure of accumulated air in the tissues about the organ itself and in the mediastinum. This emphysema in the mediastinum may also seriously impede the action of the heart.

Infection through the wound is a complication of great consequence. The trachea may be eroded and suppuration may extend deep in the neck involving important structures or into the mediastinum where there would be difficulty in dealing with it. The dangers of infection in the respiratory organs and of systemic poisoning are obvious.

Treatment should be directed to closure of the tracheal wound,

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control of hemorrhage, restoration of free respiration, prevention of increase of subcutaneous emphysema and to the avoidance of infection. Marked flexion of the head and immobilization in this position, together with some pressure upon the tissues of the neck tend to close the wound, thereby preventing or diminishing the escape of air through it, making respiration more free and diminishing the liability to infection. This plan has been followed with success in nine cases in which the diagnosis of tracheal wound was made, and should be tried in cases of moderate degree until serious symptoms supervene. In explanation of this method it may be shown that full extension of the head puts the trachea on stretch, widening the intercartilaginous spaces and carrying the trachea forward, while marked flexion tends to relax the membrane of the spaces and to approximate the rings.

Intussusception * of the trachea with the third ring caught within the second is said to have been caused by forcible sudden flexion of the head upon the chest through a heavy blow upon the back of the head.

Traumatism upon the anterior portion of the neck over the trachea followed by urgent symptoms, as marked dyspnœa, rapidly increasing emphysema with expectoration of blood and the indications of hemorrhage, which symptoms are not relieved by flexion and fixation of the head, demand exposure of the trachea for control of hemorrhage, restoring respiration by removal of material within the trachea, if necessary, and the insertion of a tracheal tube or cannula with partial closure of the tracheal wound by suture if indicated.

Complete closure of the tracheal wound by suture, as has been done in open (as cut-throat) wounds, with suitable drainage, by means of which the escaping air and the products of possible infective process may be led out through the skin incision, might be feasible. Sutures in the trachea which have to sustain the intermittent traction of its respiratory movement are known to frequently cut through or tear apart the rings. Bending the head forward and preventing its movement in this position by suitable bandage (plaster), would tend to obviate this difficulty.

* Lang, quoted by Brigel, op. cit.

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CASES IN ADDITION TO THOSE COLLECTED BY BRIGEL.

No. of Case.	Reported by, Date.	Sex. Age.	Cause.	Lesion.	Treatment.	Result.	Reference.
1	Latour, 1808.	Child, two and one-half.	Violent cough in croup.	Rupture of trachea between first and second rings.	Tracheotomy not allowed.	Died in six hours.	"Manuel sur le Croup," Orleans, 1808, p. 62; also New York *Journal of Medicine*, 1860, p. 37 (Voss).
2.....	Gescheidt, 1855?	Female, four.	Violent cough in croup.	Rupture of trachea between first and second rings.	Tracheotomy.....	Recovery.....	New York *Journal of Medicine*, 1860, p. 37 (Voss).
3.....	Zilgien, 1891.	Male, nineteen.	Fell striking neck against board.	Fracture of first ring of trachea. Fractures of cricoid and thyroid.	Ice applied.....	Died in twelve hours.	*Revue medicale de l'est*, Nancy, 1891, xxiii., p. 695.
4.....	Alcock, 1892.	Male, twenty-four.	Struck on neck by heavy beam.	Complete rupture of trachea between ninth and tenth rings, followed by abscess formation.	Ice applied.....	Died in eleven days.	*Lancet*, 1897, vol. ii, p. 793.
5.....	Montgomery. 1893.	Male, six.....	Struck across front of neck with stick.	Irregular rupture, one-half inch long, to left of median line between second and third rings.	Tracheotomy.....	Recovery	*Medical Chronicle*, Manchester, 1893, vol. xviii., p. 115.
6	Lane, 1895.	Male, fourteen.	Crush of chest between van and platform.	Rupture extending upward for two inches from bifurcation of trachea followed by abscess formation.	Stimulation.....	Died in two days.	*Lancet*, 1897, vol. i., p. 660.
7.....	Park, 1897.	Male, forty-six.	Struck on neck with stone.	Rupture of trachea (not described), followed by suppuration.	Incision into suppurating area and drainage.	Recovery	*Australasian Medical Gazette*, Sidney, 1897, vol. xvi., p. 486.
8.....	Ghedini, 1897.	Male, thirteen.	Struck on left side of neck with stick.	Fracture of trachea two centimetres long, left side.	Incision in median line of neck, exposing trachea. Iodoform gauze packed over tracheal wound.	Recovery	"Atti della Accadem. delle Scienze mediche e naturali in Ferrara," 1897-98, vol. lxxii., p. 99.
9.....	Gelpke, 1897.	Male, twenty-seven.	Compression of chest from before backward.	Multiple fractures of ribs. Laceration of trachea at incisura sterni. Pneumothorax.	Tracheotomy. Suture of part of trachea. Tracheal cannula.	Recovery	"Correspondenz-blatt für Schweizer Aerzte," vol. xxvii., 1897, p. 347.
10.....	Turner, 1898.	Male, seventy-three.	Struck on back of head by descending elevator while looking down shaft and having chest against guard-rail	Complete rupture of trachea. Fracture of sternum.	Not given.	Died in fourteen days.	*Lancet*, 1898, vol. ii., p. 1200.
11.....	Osgood, 1901.	Male, forty-two.	Kicked on chin by horse.	Rupture of trachea, one-quarter inch long, between second and third rings.	Tracheotomy.....	Recovery..... ...	

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XXII.

SARCOMA OF EXTERNAL POPLITEAL NERVE. EXCISION OF THREE AND ONE-HALF INCHES OF NERVE. UNION OF ENDS BY PLASTIC OPERATION.

By Andrew J. McCosh., M.D.

G. P. A., aged thirty-eight, a soldier by occupation, had always enjoyed good health in spite of the hardships to which he had been subjected and the rough life he had been compelled to live during ten years of very active campaigning.

In the summer of 1896, after a hard climb, he noticed for the first time a burning sensation in his toes, ankles, and legs. Soon afterward he noticed that there was some tenderness back of his left knee, which tenderness continued and at times amounted to distinct pain. In May, 1898, he first noticed a small swelling behind his left knee. These symptoms continued, but did not cause him much annoyance, until September, when, while in Cuba, he was attacked by a malarial fever, during which time the swelling increased rapidly and in the course of five weeks appeared to double in size. As soon as he had gained sufficient strength to travel, he came at once to New York for removal of the lump.

On examination, in the left popliteal space, directly posterior to the knee-joint there was seen and felt, a smooth oval tumor somewhat smaller than a hen's egg. It was hard in consistency, smooth, slightly movable and slightly tender. Pressure on the tumor caused twinges of sharp pain down the outer side of his ankle and foot. He complained of numbness and pricking sensations on the posterior and outer surface of his left leg. There was no impairment of the skin or nails. He did not complain of severe pain, but he was a man capable of bearing pain without complaint. There was some loss of power in the external muscles of the leg and some altered sensation in the skin covering the posterior and outer portion of the calf.

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The diagnosis of neuroma of the external popliteal nerve was made, but the character of the tumor was not diagnosed.

On October 12, under ether anæsthesia, a vertical incision was made over the tumor. The external popliteal nerve was seen to merge into the tumor and below the nerve again resumed its normal appearance. For the inch and a half of the nerve-cord occupied by the tumor there was recognized no nerve-structures, either around or within the tumor, which was incised for purposes of ascertaining its character and connections. Two fine nerve-filaments, passing just external to the tumor, were, however, seen. These seemed to pass but a short distance and were lost in the fascia. The tumor appeared to be a sarcoma, and it was at once recognized that removal of the tumor would necessitate an excision of three and one-half to four inches of the nerve-trunk. Accordingly the nerve was divided about three-quarters of an inch beyond each extremity of the tumor, leaving a gap of about four inches between the cut ends of the nerve. It was found impossible by either traction or position to decrease this space to less than three inches. Accordingly it was determined to unite the ends by a plastic operation. The skin incision was extended upward to above the middle of the thigh, and downward for several inches, so that five inches of the upper fragment and two inches of the lower fragment were exposed. At a point five inches above the lower end of the upper fragment, the nerve was divided half-way across and then split vertically downward along its middle line to a point three-quarters of an inch above the severed end. The ribbon of nerve thus formed was turned downward to be joined to the upper end of the lower fragment. It was found, however, that the tension would be rather great, and accordingly a similar flap, one and one-half inches long, was turned upward from the lower fragment, and the ends of the two united by means of sutures, two fine chromic, and four plain catgut sutures being employed. The wound was closed without drainage and primary union resulted throughout. The limb was placed upon a splint for five days.

The Pathologist reported as follows: "Ovoid tumor one and one-half inch by one inch, by one inch, with distinct capsule continuing over the nerve at each end. On section, for most part gray tissue of moderate consistency, but there are a few areas of pale yellowish and yellowish-brown color and of rather soft, cheesy consistency."

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Microscopical Examination:—"Sarcoma. The cells are mostly round or polyhedral, rather small, but in some parts they are spindle-shaped and among some of these there appear to be a few connective-tissue fibres." (Thacher.)

Immediately following the operation there was paralysis more or less complete of the anterior and peroneal group of muscles, and marked impairment, though not entire loss of sensation, in the outer surface of the leg. There was but little complaint of pain. On the fourth or fifth day after operation the patient noticed pricking sensations on the outer side of the leg and foot. The feeling of numbness which at first was felt in these regions gradually disappeared, and by the eighth day a prick of the pin could be distinctly felt in the anæsthetic areas. Motion at this time began to return, and on October 22, when he left the hospital, both sensation and motion were rapidly returning. On November 15, forty-three days after the operation, there was still considerable loss of power in the anterior and peroneal muscles, and some numbness and partial anæsthesia was still present on the outer surface of the leg. Improvement from this time forth was gradual. In three months he was able to walk two miles, though with a decided limp, and some loss and perversion of sensation still persisted. The conditions, however, continued to improve, though circumstances were such that he was unable to employ either electricity or massage. He returned to army duty and was an active officer during the fighting in the Philippines. In July, 1901, he returned to this country. He can walk twenty miles at a stretch and with but a slight limp, owing to slight loss of power in the peroneal muscles, which weakness embarrasses him only in marches over rough ground. His general health, three years after the operation, is excellent and there is no sign of a return of the disease, either at the seat of the former lesion or elsewhere.

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XXIII.

AN EXTENSION SPLINT FOR COLLES'S FRACTURE.

By Reginald H. Jackson, M.D.

THE apparatus here described has been used in the accident ward of the hospital for the past year with very satisfactory results in the treatment of fractures of the bones of the forearm, especially in Colles's fracture and in cases of fracture of both bones, with a tendency to overriding of fragments. In general, the important points aimed at in the treatment of these cases are :

1. Reduction.
   - *a.* Of radius.
   - *b.* Replacement of carpus in normal relation to articular surface of radius and triangular cartilage.
   - *c.* Approximation of ulna to radius when there is a tendency to spread.
2. Maintenance of Approximation.—Prevention of muscular action, which in certain cases tends to reproduce the deformity.
3. Prevention of stiffness due to—
   - *a.* Effusion.
   - *b.* Pan arthritis, etc.
   - *c.* Prolonged immobilization.
4. Comfort of Patient.—A glance at the accompanying photographs shows that these aims are accomplished by——
   1. Reduction by usual methods.
   2. Extension continuous.
   3. Approximation maintained by moulded splint.
   4. Daily massage.

Method of Application.—The forearm having been cleaned and shaved when necessary, a properly padded palmar splint is made, extending from the elbow to two and one half inches beyond tips of extended fingers.. Three strips of zinc oxide adhesive plaster are

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cut and folded as per photograph. (Fig. 1.) The forearm being placed in semiflexion, midway between supination and pronation, a strip of the adhesive plaster is applied to its inner aspect, extending from its lower third to the elbow, where it passes around the posterior extremity of the splint; two bands of adhesive are then passed in a circular fashion around the forearm and splint, thus firmly anchoring forearm. Similar strips of adhesive are then applied to the palmar and dorsal aspects of hand, extending, approximately, as high as the seat of fracture. They are further fastened by accessory circular strips around metacarpus. (Fig. 2.) Grasping the free ends of these strips in the right hand, extension can be easily and satisfactorily applied, and often aids materially in any method of reduction used; when the deformity is once reduced and extension maintained, there is little tendency for it to recur. The free ends of the straps are brought around the anterior extremity of the splint and fastened by two bands of adhesive. (Fig. 4.) The patients frequently speak of the sense of relief and comfort they experience as soon as this extension is supplied and maintained. In many cases the further application of a simple roller bandage, which may be removed each day for the purpose of massage, is all that is necessary, but in cases where there is a tendency for deformity to recur, or when the bones are spread apart, a plaster splint is applied by making a sheet, the thickness of heavy cardboard, from plaster of Paris bandages. The moment it begins to stiffen it is placed over the forearm, rapidly cut to the requisite shape, and then moulded accurately until it is perfectly hard. During these manipulations any apparent deformity may be reduced and ulna approximated to radius if indicated. When the cast is perfectly hard, it is removed and lined with canton flannel and reapplied, being held in place by a couple of adhesive bands. The arm is then placed in a sling, and the patient instructed to gently exercise fingers. When the patient returns each day the plaster cast is unhinged, turned back, and the parts gently massaged. At the end of a week the parts usually present an almost normal appearance, the effusion and swelling rapidly disappearing under the massage, which can usually be practised daily without in the least disturbing the parts, and without any great discomfort to the patient. At the end of a week to ten days, the extension is removed, the palmar splint shortened to allow full flexion of fingers. At the end

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FIG 1.

FIG. 2

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FIG. 3.

FIG. 4.

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of twelve to fourteen days, the forearm receives daily hot and cold douching in addition to the massage, the dorsal splint is then discarded, and about the eighteenth day the palmar. Patient carries his arm in a sling for a few days, when he is usually able to resume light work, the fingers and wrist being perfectly limber.

Whatever theoretical objections there may be to the apparatus, practically, they have proved nil. By using the white zinc oxide plaster, irritation of the skin is effectually avoided. No interference with the circulation has been noted from the bands of adhesive. In fractures of both bones of the forearm, with overriding of fragments from muscular contraction, good results were obtained by applying the requisite extension while examining parts with the fluoroscope and moulding cast in place.

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XXIV.

FRACTURES AND DISLOCATIONS IN THE EMERGENCY WARD OF THE PRESBYTERIAN HOSPITAL FOR THE TWO YEARS FROM OCTOBER 1, 1899, TO SEPTEMBER 30, 1901.

By Alfred T. Osgood, M.D.

FRACTURES.

- **Head** 140
  - Cranium 65
  - Face 75
    - Nasal 50
    - Malar 1
    - Zygoma 1
    - Superior Maxilla .. 3
    - Inferior Maxilla .. 20
- **Trunk** 76
  - Ribs 73
  - Sternum 0
  - Spine 0
  - Pelvis 3
- **Shoulder-girdle** ... 99
  - Clavicle 89
  - Scapula 10
- **Upper Extremity** .. 517
  - Humerus ... 116
    - Upper Extremity. 11
    - Shaft 63
    - Lower Extremity. 42
  - Radius 207
    - Upper Extremity. —
    - Shaft 78
    - Lower Extremity. 129
      - Colles's ... 125
      - Barton's .. 4
  - Ulna 84
    - Upper Extremity. 12
      - Olecranon. 10
      - Coronoid .. 2
    - Shaft 72
    - Lower Extremity. 0
  - Hand 110
    - Carpals 0
    - Metacarpals 49
    - Phalanges 61
- **Lower Extremity** .. 220
  - Femur 36
  - Patella 1
  - Tibia 50
    - Upper Extremity. 1
    - Shaft 48
    - Lower Extremity. 1
  - Fibula 75
    - Upper Extremity. 1
    - Shaft 49
    - Lower Extremity. 25
      - Pott's 24
  - About ankle. 2
  - Foot 56
    - Os Calcis 10
    - Astragalus 1
    - Tarsus 2
    - Metatarsals 28
    - Phalanges 15

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DISLOCATIONS.

Jaw	7
Clavicle	5
Shoulder	42
Elbow	19
Thumb	11
Metacarpals	5
Fingers	21
Hip	1
Knee	1
Metatarsals	2
Toes	1
Total	115

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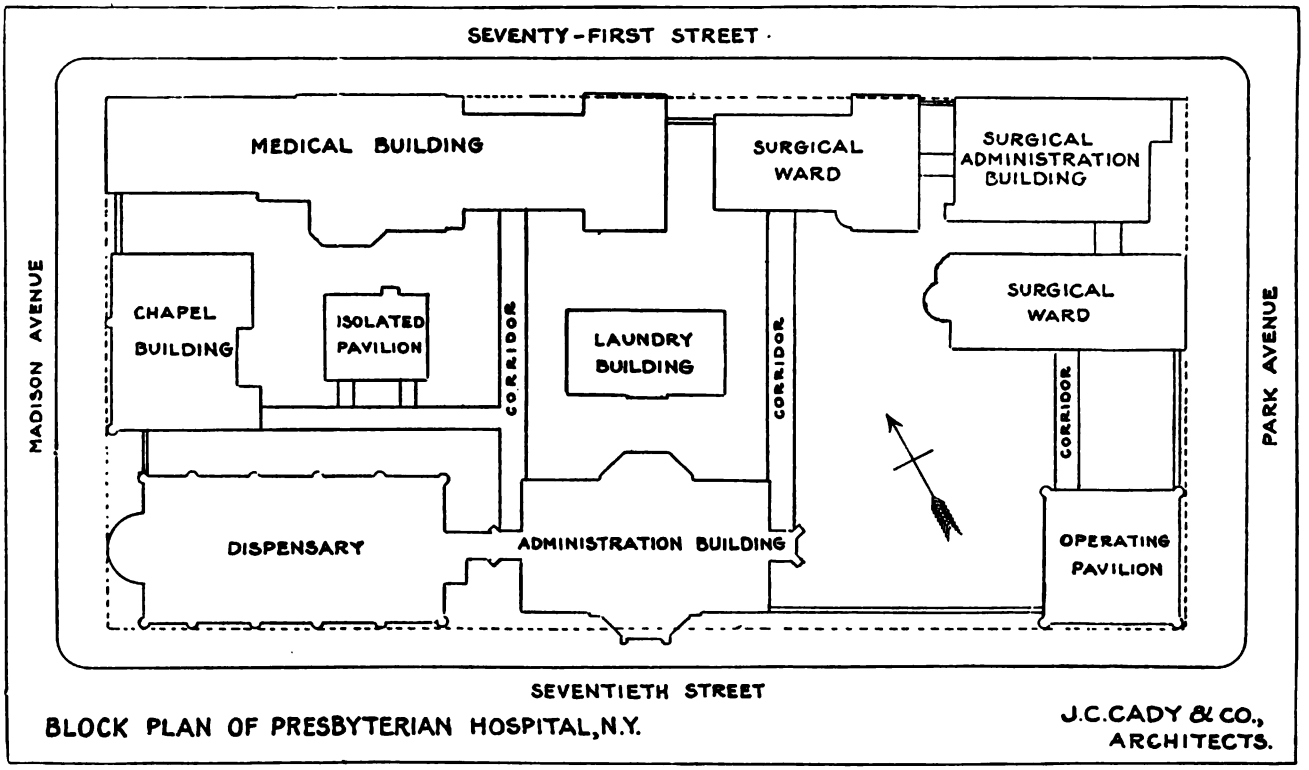

BLOCK PLAN OF PRESBYTERIAN HOSPITAL, N.Y.

J.C.CADY & CO., ARCHITECTS.

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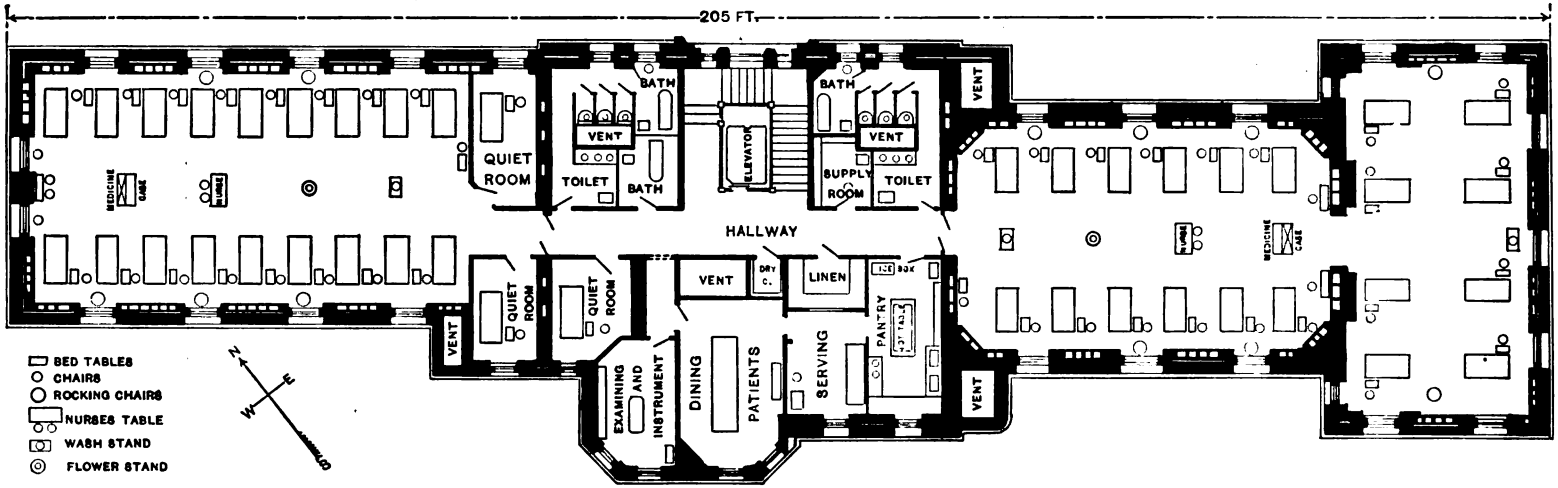

MEDICAL BUILDING.

2nd. 3rd. & 4th Floors.

SHOWING DISPOSITION OF BEDS, WARD FURNITURE AND SERVICE ROOMS.

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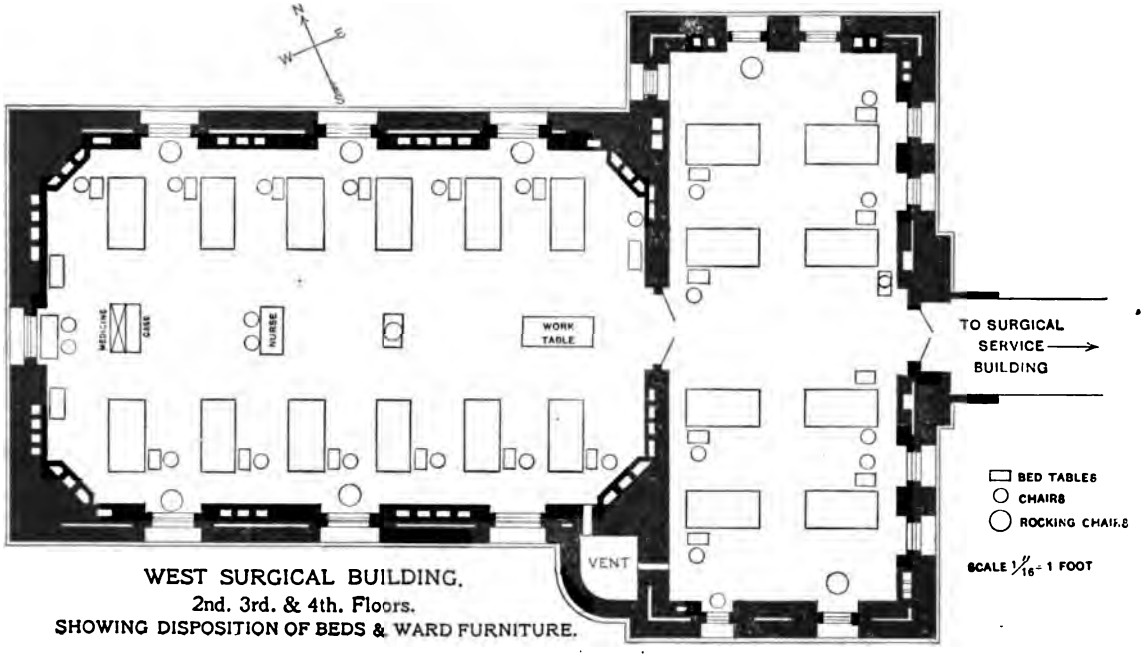

WEST SURGICAL BUILDING.
2nd. 3rd. & 4th. Floors.
SHOWING DISPOSITION OF BEDS & WARD FURNITURE.

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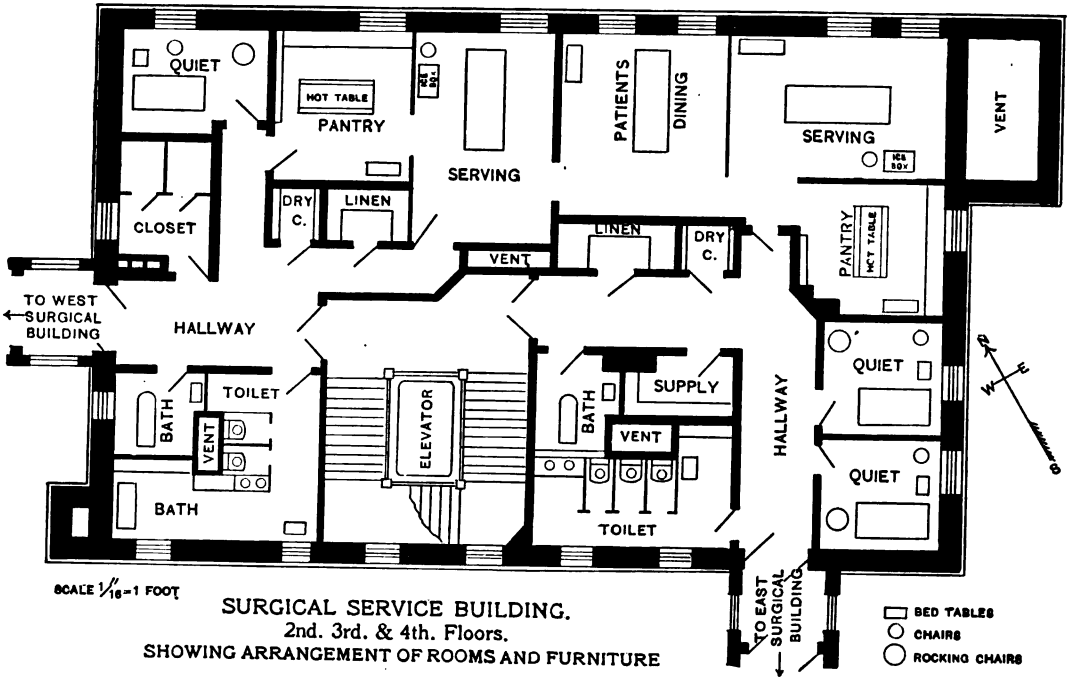

SCALE 1/16=1 FOOT

SURGICAL SERVICE BUILDING.
2nd. 3rd. & 4th. Floors.
SHOWING ARRANGEMENT OF ROOMS AND FURNITURE

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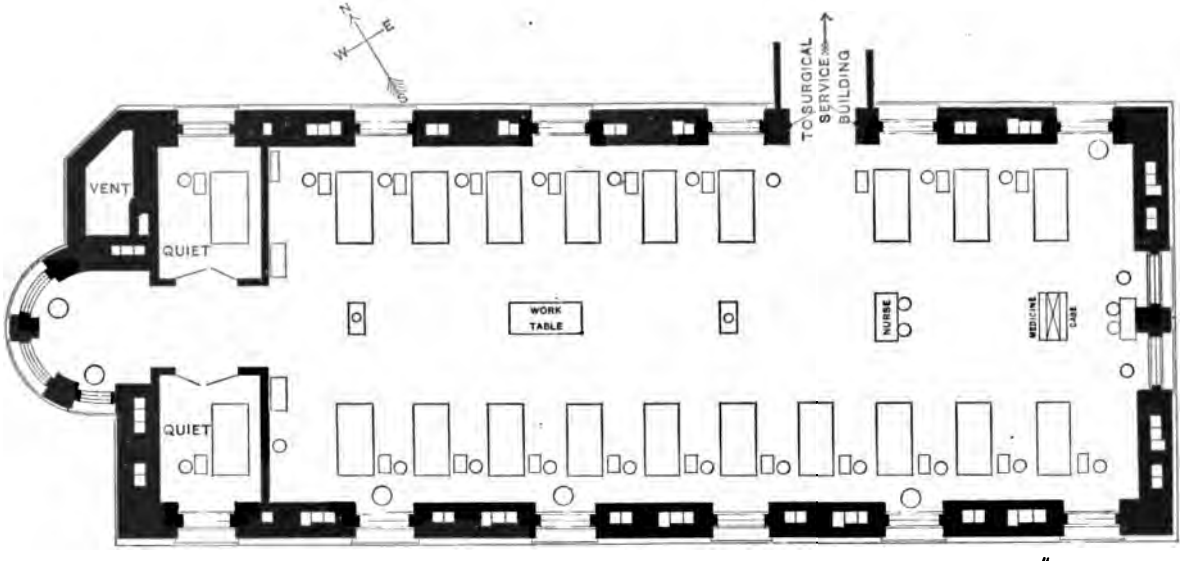

BED TABLES
CHAIRS
ROCKING CHAIRS

EAST SURGICAL BUILDING.
2nd. 3rd. & 4th. Floors.
SHOWING DISPOSITION OF BEDS & WARD FURNITURE.

SCALE 1/16" = 1 FOOT

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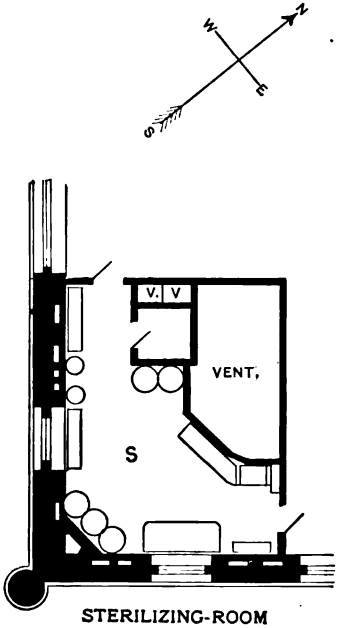
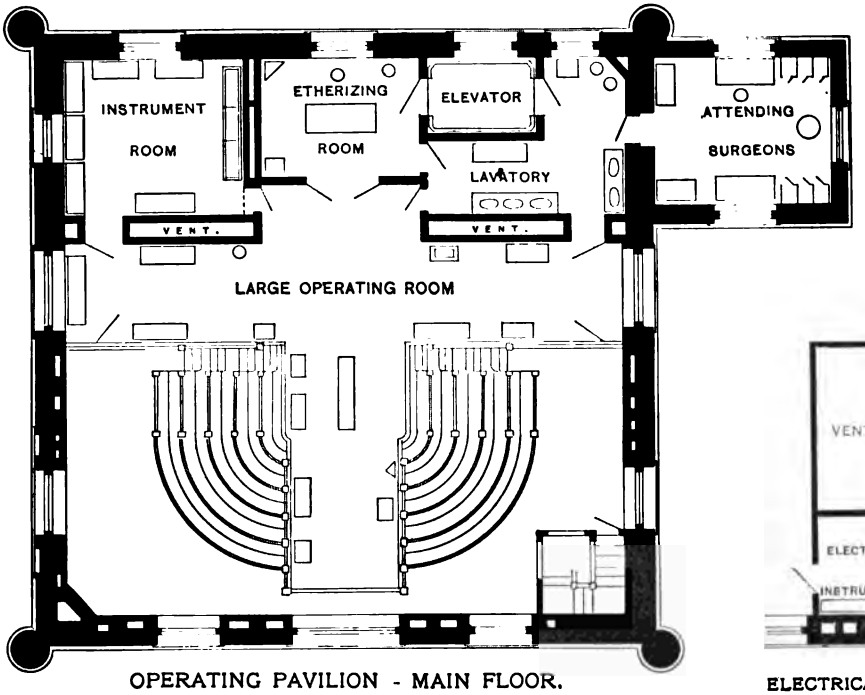
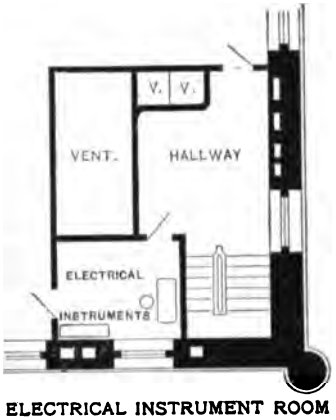


STERILIZING-ROOM
UNDER THEATRE SEATS.



OPERATING PAVILION - MAIN FLOOR.
THEATRE SEATING 120 PERSONS.



ELECTRICAL INSTRUMENT ROOM
UNDER THEATRE SEATS.

SCALE 1/16 1 FOOT

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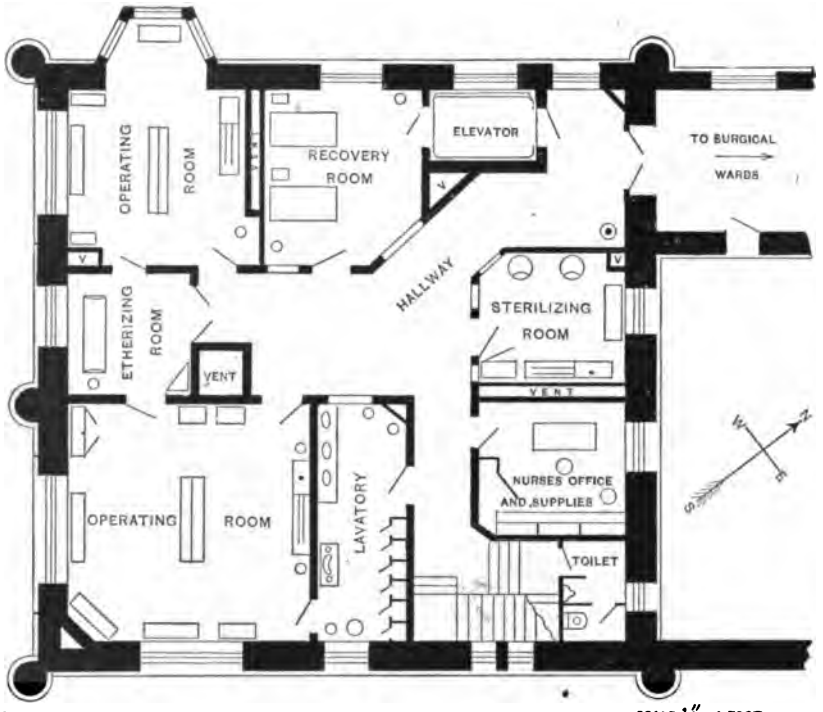
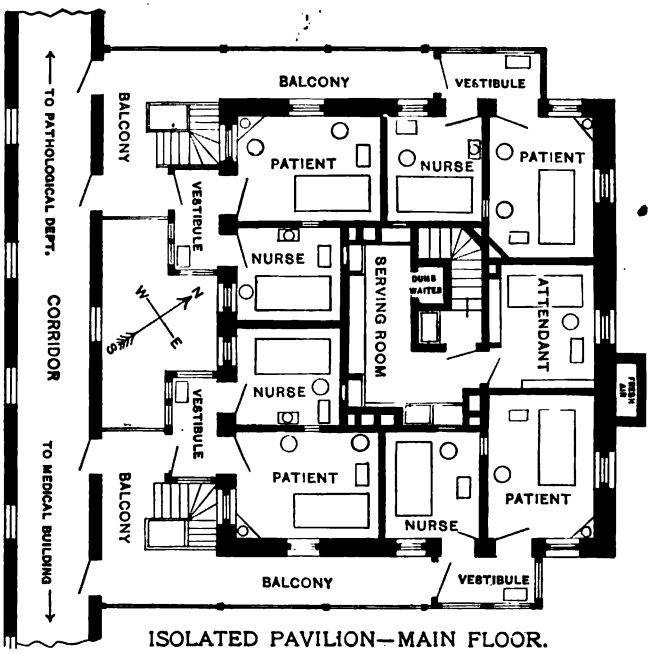


BED TABLES
CHAIRS
ROCKING CHAIRS

SCALE 1/16=1 FOOT

OPERATING PAVILION – GROUND FLOOR.



ISOLATED PAVILION—MAIN FLOOR.

BED TABLE
CHAIRS
UTENSIL STAND
WASH STANDS

SCALE 1/16 = 1' FOOT

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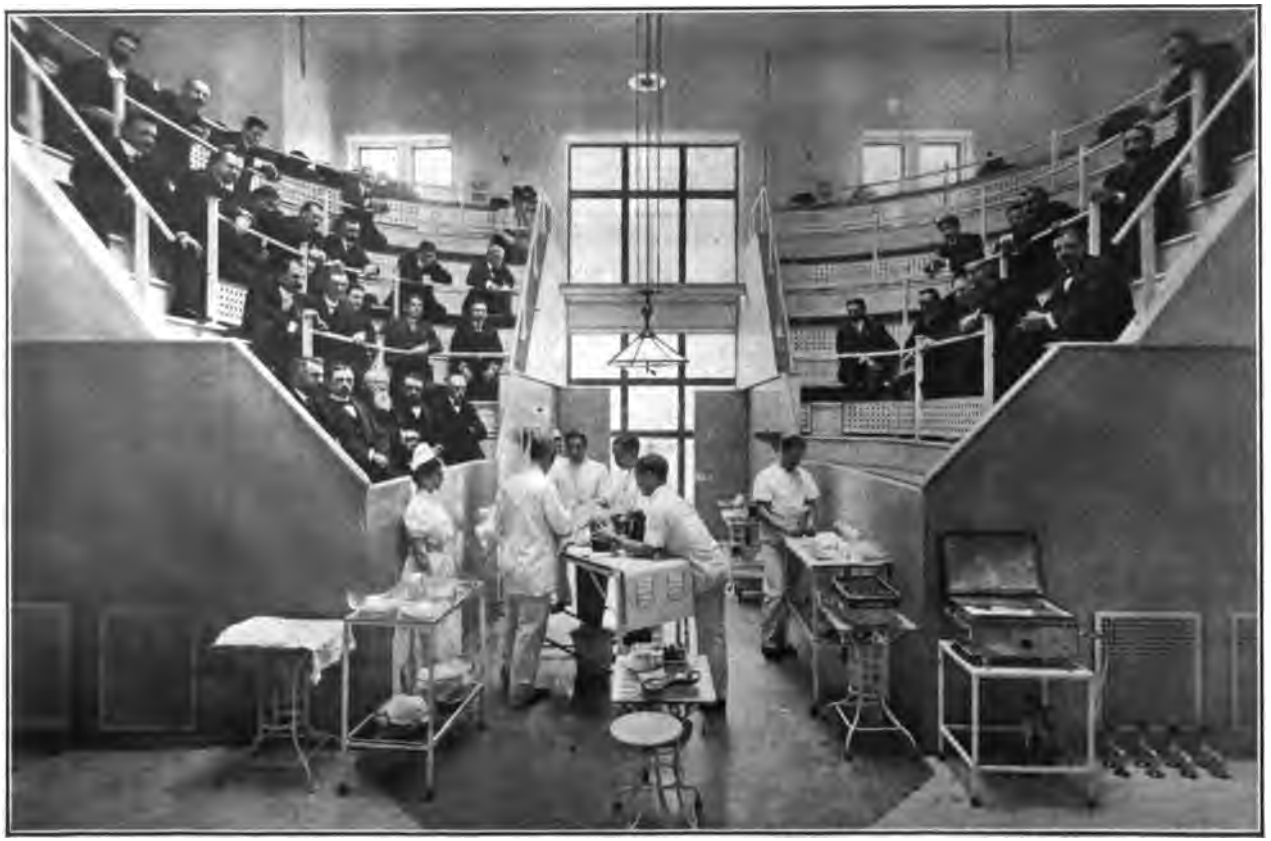

OPERATING THEATRE.

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